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Serial Number: _____

Model Number: _____

Contract No.: _____

Date: _____

**Instruction, Operation,
and Maintenance Manual**

**Fulton Oil Fired/Gas Fired
Steam Boilers**

4 HP to 150 HP

This manual is provided as a guide to the correct operation and maintenance of your Fulton Oil Fired/Gas Fired Boiler, and should be permanently available to the staff responsible for the operation of the boiler.

These instructions must not be considered as a complete code of practice, nor should they replace existing codes or standards that may be applicable.

The requirements and instructions contained in this section generally relate to the standard Fulton Oil Fired/Gas Fired steam Boiler. When installing a packaged unit, this entire section should be read carefully to ensure that the

installation work is carried out correctly.

Prior to shipment the following high standard tests are made to assure the customer has the highest quality of manufacturing:

- a) Material inspections.**
- b) Manufacturing process inspections.**
- c) ASME welding inspections.**
- d) ASME hydrostatic test inspection.**
- e) Electrical components inspection.**
- f) Operating test.**
- g) Final Inspection.**
- h) Crating inspection.**

All units can be transported with forklift. Under no circumstances should weight be allowed to bear on the jacket, control panel, or fan housing of any Fulton Boiler.

The customer should examine the boiler for any damage, especially the refractory

Rigging your boiler into position should be handled by a experienced in handling heavy equipment

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Safety Warnings Cautions & Notes

Safety Warnings, Cautions & Notes

The following **WARNINGS**, **CAUTIONS**, and **NOTES** appear in various chapters of this manual. They are repeated on these safety summary pages as an example and for emphasis.

WARNINGS must be observed to prevent serious injury or death to personnel.

CAUTIONS must be observed to prevent damage or destruction of equipment or loss of operating efficiency.

NOTES must be observed to keep boiler being operated with high efficiency.

It is the responsibility and duty of all personnel involved in the operation and maintenance of this equipment to fully understand the **WARNINGS**, **CAUTIONS**, and **NOTES** by which hazards are to be reduced or eliminated. Personnel must become thoroughly familiar with all aspects of safety and equipment prior to operation or maintenance of the equipment.

CAUTION

Some matters used for leak testing are corrosive to certain types of metals. Rinse all piping thoroughly with clean water after leak check has been completed.

NOTE

Where a return tank is to be fitted, this should:

1. Be vented and
2. Have a capacity sufficient to satisfy boiler consumption as well as maintain proper return tank temperature.

3. Vent pipe should not be downsized (This may cause pressure build up in the condensate tank).

4. Return pipes must not be insulated. This can cause overheating the return system, causing a vapor lock in the pump.

5. See Return System Instruction Manual for detailed instructions.

NOTE

Care should be taken to ensure that the blow off receptacle used meets the regulations covering such vessels. If in doubt consult Fulton for a advice.

NOTE

Only properly trained personnel should install and maintain water gauge glass and connections. Wear safety glasses during installation. Before installing, make sure all parts are free of chips and debris.

NOTE

Keep gauge glass in original packaging until ready to install.

WARNING

Improper installation or maintenance of gauge glass and connections can cause immediate or delayed breakage resulting in bodily injury and /or property damage.

NOTE

After installation is completed and prior to operation the pressure vessel should cleaned.

CAUTION

Do not store halogenated hydrocarbons near or in the boiler room.

NOTE

- a) The fused disconnect switch that controls the feed water pump should be kept in the "on" position at all times during the boiler operation as well as during the non-operating period of the boiler.
- b) This switch should be turned "off" only when repairs or adjustments should be made.

NOTE

The pump will continue to operate until the water reaches the correct level in the boiler. This level is approximately the center of the water gauge glass.

WARNING

Prior to the commencement of any work requiring the removal of cover plates and the opening of the control panel box, the electrical supply to the boiler must be disconnected.

CAUTION

Do not tamper with the safety features of the low water safety cut off.

CAUTION

When stopping the boiler for any extensive repairs, shut off main disconnect switches on both the boiler side as well as the feed water side.

NOTE

To ensure that your Fulton Steam Boiler is kept operating safely and efficiently, follow the maintenance procedures set forth in Section 4 of this manual.

Safety Warnings Cautions & Notes

NOTE

The flame scanner is located on the outside edge of the burner top plate for 20HP-150HP.

NOTE

If the boiler is being operated automatically on a time clock, the blow off operation may be done once before boiler is operated during the working day and once at the end of the day (when at 10 PSIG).

NOTE

Fulton recommends that feed water treatment should be performed before it is added into the boiler.

WARNING

Make sure main power switch is off before starting work.

CAUTION

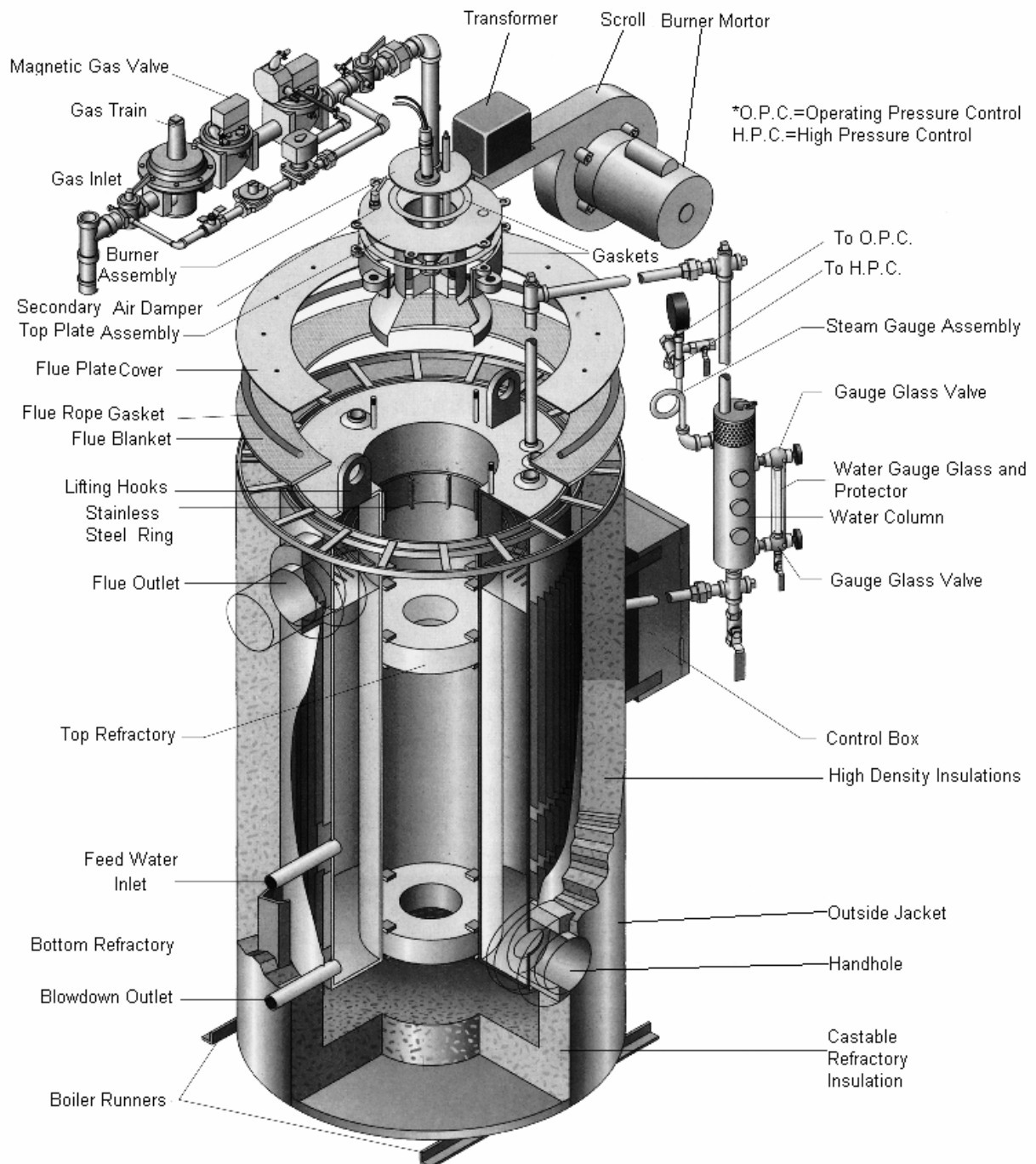
Do not clean the gauge or glass while pressurized or in operation.

NOTE

After a new Fulton Boiler has been in operation for several months, pieces of burned metal will be found in the space at the bottom of the boiler. These pieces of metal act as the formed combustion ring effect during manufacture. This is a normal condition and does not affect the efficiency and the life of the boiler in any way.

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Description/Instruction



Description/Instruction

Specifications

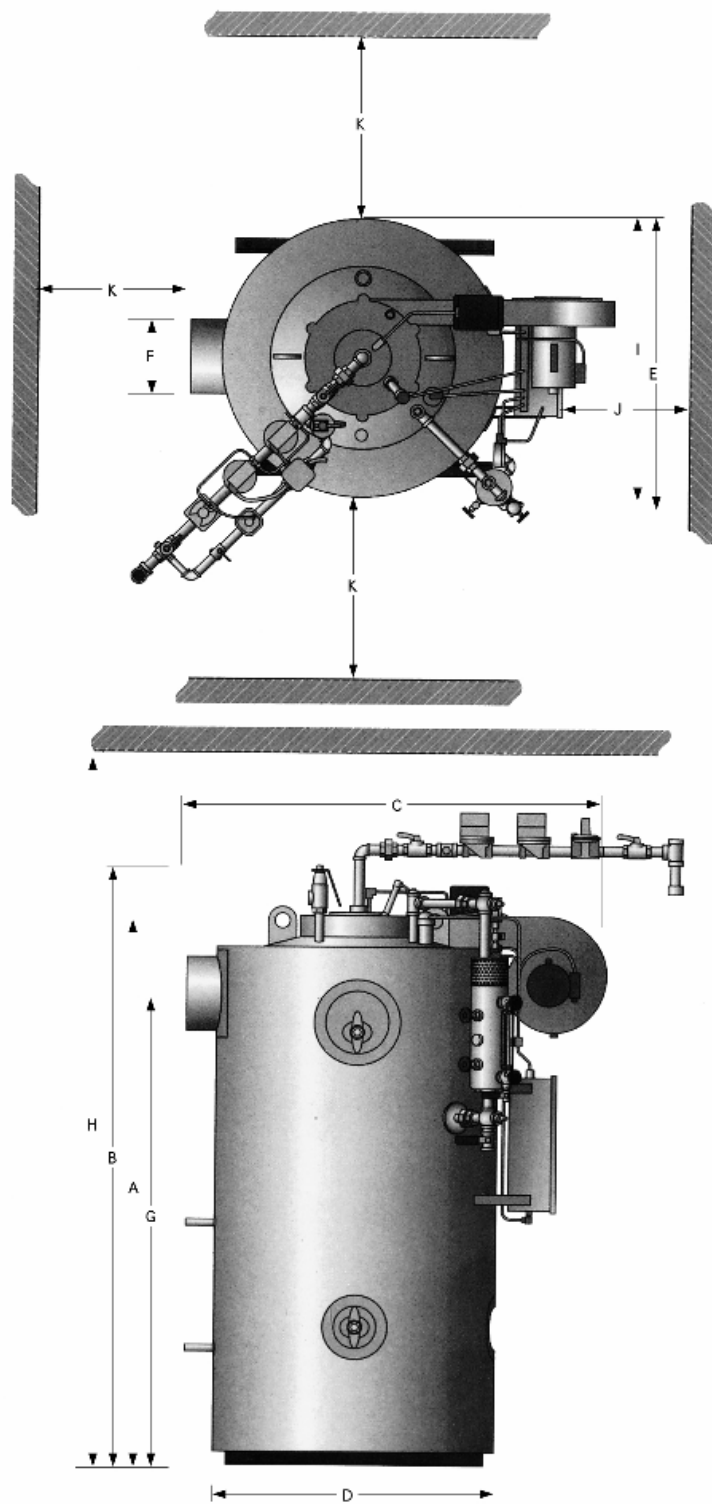
Standard Models FBA&ICS	4	6	10	15	20	30	40	50	60	80	100	130	150	
Boiler HP	4	6	10	15	20	30	40	50	60	80	100	130	150	
Ratings (sea level to 914m)*														
Output(steam)	lb/Hr	138	207	345	518	690	1035	1380	1725	2070	2760	3450	4484	5175
	kg/Hr	63	94	157	235	312	470	627	783	939	1252	1565	2034	2348
Approximate oil (gas) Consumption at Rated Capacity														
Light oil **	kg/h	3.77	5.65	9.42	14.71	18.91	29.07	38.41	48.80	58.14	76.10	91.31	121.75	140.55
Town gas	m³/h	12.06	18.09	30.14	47.06	60.50	93.02	122.92	156.15	186.05	243.51	292.21	358.61	413.97
Propane gas	m³/h	1.88	2.81	4.69	7.32	9.41	14.47	19.12	24.29	28.94	37.88	45.45	60.61	69.97
Natural gas	m³/h	4.74	7.11	11.85	18.51	23.79	36.58	48.34	61.41	73.16	95.76	114.91	153.22	176.87
Natural gas boiler	IN	1	1	1	1	1.25	1.5	1.5	1.5***	2	2.5	3	3	3
Connection size	mm	25	25	25	25	32	38	38	38	50	64	76	76	76
Burner	3450RPM/60CY					GAS OIL	GAS OIL	GAS OIL	GAS OIL	GAS OIL	GAS OIL	GAS OIL	GAS OIL	GAS OIL
Motor HP	2850RPM/50CY	1/3	1/3	1/3	1/3	1/3 3/4	1/3 3/4	1½ 2	1½ 2	1½ 2	2 3	3 3	4 4	4 4
Electric Power Requirements (In Amps)														
220V/50CY/1Phase	3.5	3.5	3.5	3.4	5.3	5.3	-	-	-	-	-	-	-	-
380V/50CY/3Phase	-	-	-	-	-	-	3.7	3.7	3.7	4.6	4.6	6.2	8	8
Control voltage 220V/50CY/1Phase	2	2	2	2	2	2	2	2	2	2	2	2	2	2

Notes:

* All ratings at 212 degree F(100°C).

**Fuel consumption based on Light oil 11200 kcal/kg, propane gas 22500kcal/ m³, Natural gas 8900 kcal/ m³, Town gas 3500 kcal/ m³.

***Apply IRI and CSA standard time: 2 inch (50mm).



Description/Instruction

Dimensions and Weight

Boiler	HP	4	6	10	15	20	30	40	50	60	80	100	130	150
Height and Width														
A. Height of Boiler	iN mm	47 1194	57 1448	63 1600	69 1753	72 1829	82 2083	73.5 1867	87 2210	93 2362	93 2362	99 2515	117 2972	117 2972
B. Boiler height with Trim and fuel train assembly	IN mm	65 1651	75 1905	80.5 2045	86.5 2197	92.5 2350	102 2591	94 2388	106.5 2705	120 3048	122 3099	125 3175	134 3395	136 3582
C. Overall Depth Stack to Burner Fan Housing	IN mm	44 1118	44 1118	46 1168	47 1194	60 1524	67 1702	73 1854	78 1981	78 1981	90 2280	120 3043	134 3043	136 3395
D. Boiler Diameter	IN mm	26 660	26 660	28 710	30 760	39 990	46 1170	55 1400	55 1400	55 1400	63 1588	68 1740	76 1936	76.5 1943
E. Overall width (with water column)	IN mm	33 838	33 838	33.5 851	35.5 902	43 1091	49 1244	57 1448	57 1448	57 1448	67 1702	75 1905	83 2108	84.5 2146
F. Flue outlet Diameter	in. mm	6 152	6 152	6 152	8 203	10 254	12 305	12 305	12 305	12 305	14 356	14 356	16 400	16 407
G. To Center of Flue Outlet	in. mm	42 1070	52 1320	58 1473	63 1600	66 1675	73.5 1867	65 1651	79 2007	85 2159	95 2423	95 2423	107 2723	110 2794
Minimum Clearance														
H. The least height Required for Replacing burner	in. mm	72 1828	82 2083	86 2184	92 2337	96 2438	106 2692	104 2642	114 2896	124 3149	126 3200	129 3277	151 3835	157 3988
J. The Front f The Boiler	IN mm	41 1041	41 1041	41 1041	41 1041	41 1041	41 1041	41 1041	41 1041	41 1041	41 1041	41 1041	41 1041	41 1041
K. Sides & Rear of Boiler	IN mm	36 915	36 915	36 915	36 915	36 915	36 915	36 915	36 915	36 915	36 915	36 915	36 915	36 915
Water Content	U.S.GAL LITERS	14 53	16 61	24 91	39 148	77 292	170 643	220 835	245 927	270 1022	375 1419	580 2195	876 3317	904 3423
Weight	LB	1400	1700	2000	2280	3400	4780	6400	6526	7280	10506	11608	14918	15550
Approx. Shipping Weight	KG	640	770	910	1035	1545	2170	2905	2963	3305	4770	5270	6773	7060

Note:

**** Clearance for boilers below 50PSIG are 18"(457mm) on sides and rear of boiler**

Locating the Boiler

- a) The boiler should be located in dry surroundings on a level base, making sure that there is sufficient room around the boiler to enable the operator and/or the maintenance engineer to gain access to all parts of the boiler. Check location for ease of water supply and electrical connections.
- b) Place the boiler on a noncombustible floor with clearances to unprotected combustible materials, including plaster or combustible supports.
- c) It is necessary to have the sufficient clearance from the floor to the ceiling for removal of the burner.

The Fuel Oil Supply

- a) Be sure that the oil supply lines from the tank to the burner are of proper size. Vacuum should not exceed 10" of mercury at the oil pump inlet.
- b) All Fulton oil burners are of the two pass design system requiring a return line and supply line. The oil pump is factory set at 230 psi ($=16 \text{ Kg/cm}^2$). Do not change this setting without allowance of Fulton Boiler..
- c) A stop valve, a check valve, and an oil filter must be installed in the oil supply line.
- d) When one oil line is feeding two burners, a check valve must be installed in each unit.
- e) Make sure there are no loose fittings. Loose fittings in the fuel oil line will allow air to enter into the fuel line and cause improper firing.

The Gas Supply

- a) Gas piping should be installed in accordance with National Fuel Gas

Code, and any other local codes which may apply.

- b) Install a dirt trap ahead of all of the gas valves.
- c) The pipe and the fittings used must be new and free of dirt or other deposits.

d) The piping must be of the proper size to ensure adequate gas supply to the gas head assembly. Consult your gas company for specific recommendations.

e) For natural gas a pressure of 7" to 11" (178mm to 279mm) of water column pressure at the gas train is required with burner firing. Do not exceed 13" of water column.

f) For propane or butane gas the pressure required is 11"(279mm) of water column pressure. Again, do not exceed 13" of water column.

g) When making gas piping joints, use a compound to seal the gas line threads. Do not use Teflon tape on gas line threads.

h) The main and the pilot gas pressure regulators must be vented to the atmosphere.

i) After gas piping is completed carefully check all piping connections, for gas leaks. Use a soap and water solution.

Caution

Some matters used for leak testing are corrosive to certain types of metals. Rinse all piping thoroughly with clean water after leak check has been completed.

j) The boiler must be disconnected at the boiler shut off valve from the gas supply piping system when intake gas pressure is in excess of

14"W.C.

k) The boiler must be isolated from the gas supply piping system by closing the shutoff cock during any pressure testing of the gas supply piping system at pressure equal to or less than 1/2 PSIG-14"W.C.

Description/Instruction

Boiler, Condensate Tank, And Blow off Separator

NOTE

Where a condensate return tank is to be fitted, this should:

1. Be vented.
2. Have a capacity sufficient to satisfy boiler consumption as well as maintain proper return tank temperature.
3. Vent pipe should not be downsized (this may cause pressure build up in the condensate tank).
4. Return pipes must not be

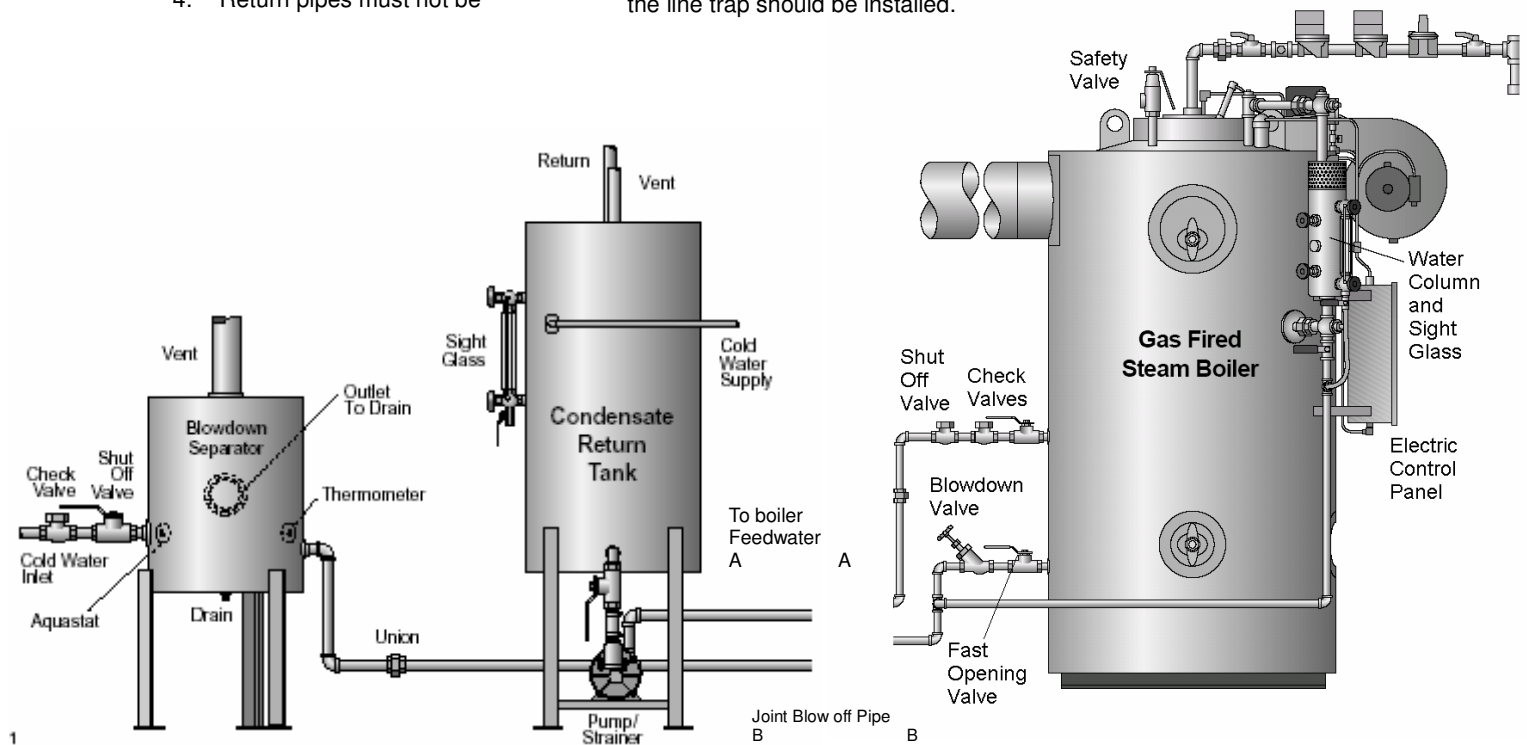
insulated. This can cause overheating the return system, causing a vapor lock in the pump

NOTE

To be sure that the blow off separator used is in accordance with the local codes. If there are any questions, consult with Fulton Company.

- a) Make sure two check valves are installed between the boiler and pump (one check valve is pre-fitted).
- b) In a closed system an end of the line trap should be installed.

- c) There are three blow off valves on the boiler, the main valve at the rear of the boiler, the water gauge glass blow off valve and water gauge blow off valve. The boiler blow off valves supplied with the boiler should be connected to the blow off pipe in accordance with specifications. Use specified blow off pipe to connect with blow off receptacle. All these procedures should be done in accordance with local codes. The water gauge and water gauge glass blow off valve should be connected to the main blow off line.



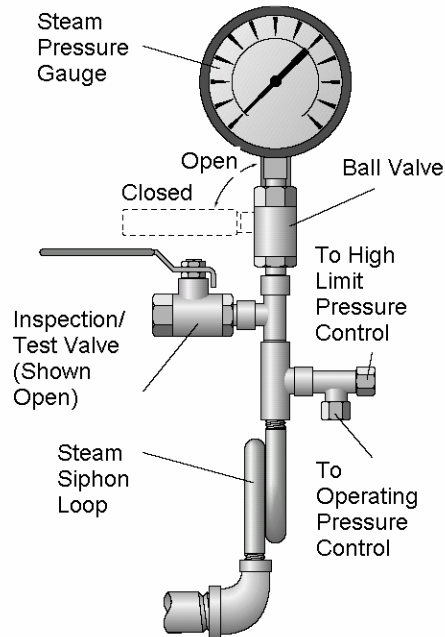
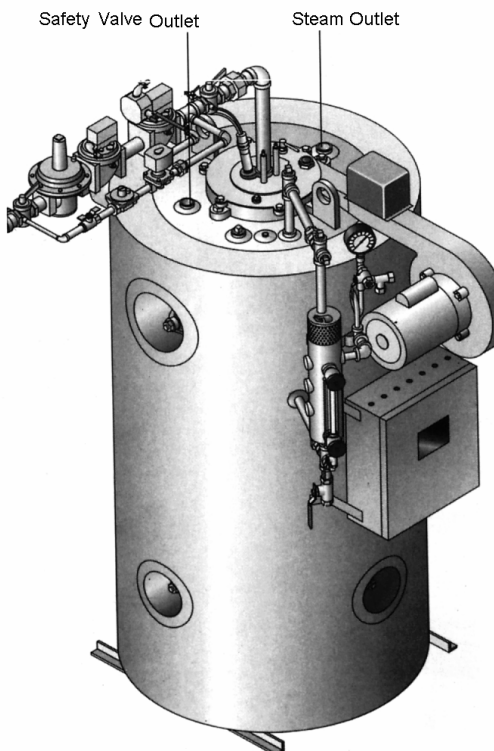
Description/Instruction

Boiler Installation

The Steam Supply—Pipe the steam supply line from the top right side of the boiler.

The Steam Safety Valve

- 1) Before installing, be sure that all pipes and connections have been blown clean. Pipe sealing dope is used on external threads only. Be sure inlet of valve is free of any foreign material to avoid leakage of safety valve.



- 2) Do not use a pipe wrench. When making installation, use proper type and size wrench.
- 3) The valve should be installed in a vertical upright position in the connection provided on the top left side of the boiler. Under no circumstances should there be a shut off valve or restriction of any kind between the safety valve and the connection provided.
- 4) Do not cap or plug drain hole in the side of valve body.
- 5) Since the purpose of this safety valve is to protect against an overpressure situation, it will loudly discharge hot steam in doing so. Therefore, it is recommended that a discharge pipe be securely installed and run to a safe point disposal.
- 6) When a discharge pipe is used, it must be of a pipe size equal to or greater than that of the valve outlet. Use pipe with

sufficient strength, extra strong or double extra strong discharge pipe or connections, and it should be short and straight as far as possible to reduce the pressure on safety valve. It must have an ample provision for draining condensate at or near the valve outlet. It must terminate freely to atmosphere and maintain normal atmosphere pressure (no pressure difference with outside).

The Steam Pressure Gauge Assembly

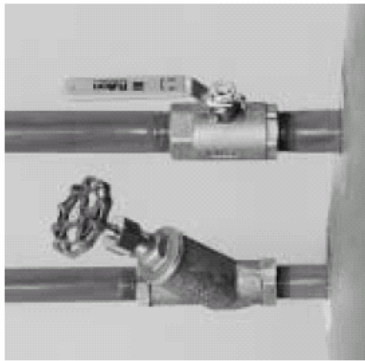
The gauge should be facing front towards the panel box and /or operator of the boiler. Except as noted, each assembly or any of its component parts may be oriented, other than shown to provide improved operating clearance and /or view of gauge. Before installing steam gauge on the siphon, add a small amount of distillate to the gauge element for sealing. This must be completed to prevent inaccurate pressure readings and /or

Description/Instruction

premature failure of the gauge. Install the steam gauge into the siphon on the water column.

The Blow-off Valve

There are three blow off valves on the boiler, the main valve at the rear of the boiler, the water gauge glass blow off valve and water lever blow off valve. The boiler blow off valves supplied with the boiler should be connected to the blow off pipe in accordance with specifications, Use specified blow off pipe to connect with blow off receptacle. All these procedures should be done in accordance with local codes.



The feed Water Piping

1) Provisions must be made for adequate water supply and properly sized piping. Piping must be done in compliance with all local codes. The following chart may be used as a guideline for sizing.

Minimum Water Supply Piping Size

BHP	Inch	Millimeter
4	1/2	12.5
6	1/2	12.5
9.5	1/2	12.5
10	1/2	12.5
15	3/4	19
20	3/4	19
30	1	25
40	1	25
50	1	25
60	1	25
80	1-1/4	25
100	1-1/4	31.7
130	1-1/4	31.7
150	1-1/4	31.7

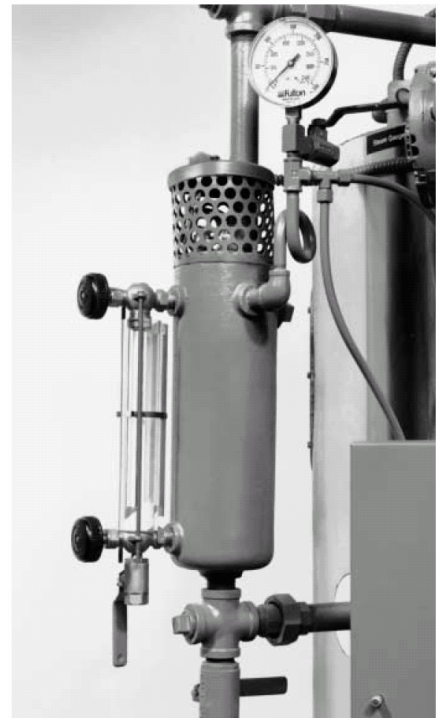
2) When feeding the boiler using a return system, the feedwater makeup pressure should not exceed 40 lb/in². A pressure reducing valve should be installed ahead of the return tank above this pressure.

3) It is important that all piping be lined up and not forced into place. It is recommended that you begin piping at the pump, if line the piping at reversed direction, particularly if the last piece is cut too short or long, the pump will be forced to meet the pipe and strain or distortion will result.

4) Do not use the pump as a piping

support. It is critical that the pipe be independently supported near the pump so no strain will be transmitted to the unit.

5) Connect the feed water stop valve to the water pipe at the rear of the boiler and pipe it to the return system.



The Water Column

Install the piping from the water column and water gauge glass to a safe blow-off point.

Water Gauge & Gauge Glass Installation Instructions

Note

Only properly trained personnel should install and maintain water gauge glass and connections. Wear safety glasses during installation. Before installing, make sure all parts are free of clips and debris.

Note

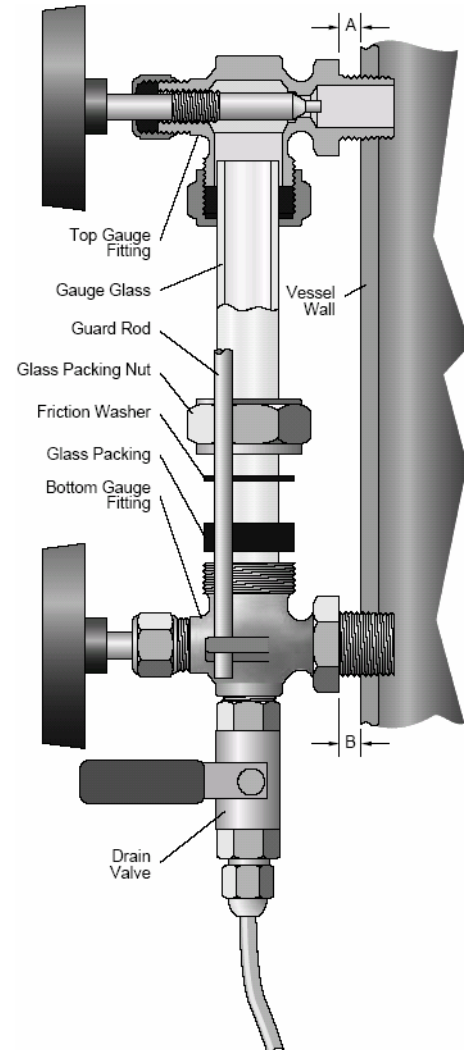
Keep gauge glass in original packing until ready to install.

- 1) Verify the proper gauge has been supplied.
- 2) Examine the gauge glass and packing carefully for damage before installation. Do not use the glass if it contains any scratches, chips, or any other visible signs of damage.
- 3) Do not subject the gauge glass to bending or torsion stresses.
- 4) Apply PTEE tape or emulsion to pipe threads. Install top gauge fitting (fitting without a drain valve) into the uppermost tapping. Wrench tight the fitting until it is snug and the glass outlet is pointing at five o' clock.
- 5) Install the bottom gauge fitting (fitting with a drain valve) until it is snug and the glass outlet is pointing directly upward. Verify top and bottom fittings are threaded into the tapings the same number of turns (distance A=distance B)

- 6) Remove glass packing nut, friction washer and glass packing from the fittings, and place them in the same order, on both ends of the gauge glass. Push both packing about an inch up the gauge glass.
- 7) Gently insert one end of the glass into the gauge fitting. Keeping the glass inside the top fitting, gently rotate the top gauge fitting clockwise until vertically aligned with the bottom gauge fitting, then inset glass into bottom fitting until glass bottoms out on the shoulder inside the bottom fitting.
- 8) Carefully raise glass about 1/16" (1.6mm) and slide lower glass packing down until the glass packing contacts the lower gauge fitting. **DO NOT** allow the glass to remain in contact with any metal.
- 9) Carefully slide upper glass packing up as far as possible.
- 10) Hand tighten both glass packing nuts, then tighten 1/2 turn more by wrench. Tighten only enough to prevent leakage. **DO NOT OVER TIGHTEN.** If any leakage should occur, tighten slightly, a quarter turn at a time, checking for leakage after each turn.
- 11) Install the protective guard. Gauge glass valves utilize automatic ball checks to help prevent injury in case of glass breakage.

WARNING

Improper installation or maintenance of gauge glass and connections can cause immediate or delayed breakage resulting in bodily injury and /or property damage.



Description/Instruction

Water supply

a) Feed water contains solids and dissolved gases. These may promote incrustation of scale; corrosion etc.. To prevent this, feed water must be studied individually and treated accordingly by reputable professionals specializing in this field. It is strongly recommended that a competent water treatment specialist be consulted prior to the installation of the boiler.

b) The purpose of this treatment should be to provide quality feed water to the boiler such that corrosion and deposition in the boiler will be minimized.

Dissolved oxygen, high chloride levels and low PH can all be major causes of corrosion. Untreated hardness is the major cause of deposits. Poor quality feed water requires increased blow off and increased chemical treatment costs to prevent boiler corrosion and scaling.

c) One way to lower the amount of dissolved oxygen in the boiler feed water is the sparge tube option. This option injects live steam into the feed water to increase the water temperature to 82 degrees C which remove oxygen from the water.

d) Chlorides can be controlled by increasing the number of blow down per day from one to four.

e) The Fulton warranty does not cover damage or failure that can be attributed to corrosion, scale or dirt accumulations. Oxygen is a corrosive. See the Warranty Section of this manual for full details.

Recommended Water Treatment

The boiler should be in accordance with GB1576-2001, 《Industrial Boiler Water Quality》. Following are detail data for feed water treatment outside the boiler:

ITEM		FEED WATER	BOILER WATER
Rated steam pressure	MPa	$>1.0, \leq 1.6$	$>1.0, \leq 1.6$
Suspended Solids	mg/L	≤ 5	-
Hardness	mmol/L	≤ 0.03	-
Alkalinity	mmol/L	-	6-24
PH(25°C)		≥ 7	10-12
Dissolubility	mg/L	≤ 0.1	-
Dissolved Solids mg/L	With Super heater	-	< 3500
	Without Super heater	-	< 3000
SO ₃ ²⁻	mg/L	-	10-30
PO ₄ ³⁻	mg/L	-	10-30
Relative Alkalinity	$\frac{\text{Free NaOH}}{\text{Dissolved Solids}}$	-	< 0.2
Oil	mg/L	≤ 2	-
Iron	mg/L	≤ 0.3	-

Note: Oxygen had better be removed to make a dissolubility of equal to or less than 0.1mg/L. If there is partial corrosion because not removal of oxygen, the action must be done for removing.

Glossary of Water Supply

Dissolved Oxygen: Oxygen that is dissolved in the feed water will cause the steel in the boiler and the feed water system to be attacked by the water in a manner described as “pitting”. The pits that are produced can vary from tiny depressions to holes large enough to penetrate the boiler metal and are usually covered with tubercles of iron oxide. Once pitting starts, it may be extremely hard to arrest. Pitting can proceed at a surprisingly rapid rate and can occur not only in the boiler proper, but also in pre-boiler equipment such as economizers, feed water heaters, and feed water lines.

Sodium Sulfite Its purpose is to chemically remove the dissolved oxygen left in the feed water. Sodium Sulfite reacts chemically with dissolved oxygen, producing sodium sulfate. Since it is desirable to remove dissolved oxygen from the feed water before it reaches a boiler. Sodium sulfite is best introduced continuously at some suitable point in the feed water system (the storage section of the feed water heater, six inches below the water line). Chemical residual control is based on the maintenance of a specific excess of sodium sulfite in the boiler water. The essential requirement being to maintain in the feed water at all times slightly more than enough sodium sulfite to consume all of the dissolved oxygen. When sodium sulfite is not fed continuously, protection of the boiler against oxygen attack must depend on the reserve of sodium sulfite that is present in the boiler water. In this case, it

is important that the feed water and the boiler water are mixed thoroughly and as quickly as possible so that boiler water sodium sulfite may consume feed water oxygen before the latter can cause damage to the boiler.

Sulfite as a treatment represents a second line of defense against oxygen corrosion. A vigorous maintenance program to safeguard against oxygen leakage into the pre-boiler system should be followed.

Suspended Solids:

Suspended solids are the undissolved matter in water, including dirt, silt vegetation, and any other insoluble organic matter. Normally suspended solids are expressed in terms of turbidity. The presence of suspended solids in cooling water can increase impingement type corrosion. Suspended solids may also deposit in low velocity areas and create differential aeration cells. Pitting can result. The most common cause of high suspended solids is high hardness feed water. Of the agents which cause foaming, suspended solids probably have the least effect. Reasons for the increased hardness or other suspended solids should be determined. In line filters or various types of pretreatment can be used to lower the suspended solids level. Various polymers assist in holding solids in suspension.

Alkalinity: Alkalinity is the capacity of a water to neutralize acids. Common water alkalinities consist of bicarbonate, carbonates, hydroxide, phosphate, and silicate. These alkalinities, especially bicarbonates and

carbonates, break down to form carbon dioxide in steam, which is a major factor in the corrosion on condensate lines. High alkalinity also causes foaming and carries over in boilers.

Both foaming and carry over cause erratic boiler operation. When foaming occurs an anti-foam should be added or increased. The reason for the high alkalinity should be determined. It may result from lack of sufficient blow off. Pretreated makeup water and condensate should also be checked. Quite often the source of alkalinity is an overdose of alkaline internal water treatment chemical.

pH: pH is a measure of the degree of acid or base of solution. Normal pH ranges of 6.5-9.0 will have little influence on the corrosion rate of cooling waters. If for some reason—pollution, etc.—the pH is lowered into the acid range, increased corrosion can be expected. The solution lies in determining the cause of the low pH and correcting that condition. A low pH can result in corrosion of metals, while a high pH can result in scale formation. In order to control boilers and equipment used for the external treatment of make up water, it is essential that reliable pH measurements be made.

Phosphates: Ground or surface waters seldom contain large amounts of phosphates. If present, it generally indicates fertilizer runoff or pollution. Phosphate from raw water can be the cause of scale problems in open recirculation cooling water systems after the water is concentrated.

Chlorides: Chlorides are involved in most cooling water

corrosion cells. Other factors being equal, it can be assumed the higher the chloride content, the more corrosive the water. When pits or cracks occur on stainless steel or other metals, chlorides are always suspect.

High chloride levels can cause severe corrosion. Corrosion from chlorides can be controlled by increasing the amount of corrosion inhibitor or changing to a more effective inhibitor.

Oil: Oil is not a natural constituent of boiler water; still it can frequently enter a system through leaks in a condenser or other heat exchanger. Oil can also enter a system through the lubrication of steam driven reciprocating equipment. Whatever the source, the presence of oil in boiler water is undesirable. Oil can act as a binder to form scale. In high heat transfer areas oil can carbonize and further contribute to the formation of scale.

Foaming is one indication of oil in boiler water. Its presence can also be confirmed by first shaking a bottle containing boiler water. If oil is present foam will result. To ensure the foaming is being caused by oil, add a small amount of powdered activated carbon to the bottle containing the boiler water and shake. Little or no foam will appear if the foaming is caused by oil.

Often oil in boiler water will originate in the condensate. This contaminated condensate should be directed to the sewer until the source of the oil is determined and corrective steps taken.

Silica: Silica in boiler deposits

is usually combined with other constituents. Silicates form a number of different scale complexes with calcium, magnesium, aluminum, sodium, and iron. Since there is at present no effective dispersant for silicate deposits, the scale problem can be alleviated by maintaining close control of calcium, aluminum, and iron as well as silica.

Iron (oxides): Iron in any of its oxide or complex forms is undesirable in boiler water. It is very difficult to disperse so that it can be removed the bottom blow off lines.

Iron in its various forms can originate in the raw water makeup, condensate return water, or form directly in the boiler as a result of corrosion. Most iron oxide originates outside the boiler. It does not concentrate in the boiler and it tends to collect in stagnant areas. If a boiler is using raw water makeup, iron is almost certain to be a major component of developing scale.

Water Hardness: Water hardness is the measure of calcium and magnesium content as calcium carbonate equivalents. Water hardness is a primary source of scale in boiler equipment.

Feed water: Feedwater is the combination of fresh makeup and returning condensate that is pumped to the boiler.

Condensate: Condensate is condensed steam that is normally low in dissolved solids. Hence, it does not contribute to the dissolved solid content of the feed water. In addition, condensate is very expensive to waste. It's been chemically

treated, heated, pumped, converted to steam, and condensed. This costs money and when condensate is returned to the boiler, money is saved.

Electrical Requirements

a) Connect wiring as shown in the wiring diagram which is furnished inside the electrical control panel box.

b) Be sure to install a separate fused disconnect for each. The disconnect should be installed in compliance with all local codes.

c) Connections for an optional audible alarm are provided in the control panel and are clearly indicated on the diagram.

Fresh Air Supply for Boiler Room

a) It is most important to provide free access of air to the boiler. 6.4cm² is needed for every 756 Kcal).

b) Proper ventilation of the boiler room is essential for good combustion. **Install two fresh air openings**, one at a low level of 610mm from floor and one at a higher level on the boiler room (See the picture). This will provide a flow of fresh air intake into from the bottom hole and exhaust the hot air from the top hole.

c) The following openings are recommended for each size boiler:

Description/Instructions

Make UP Air Openings

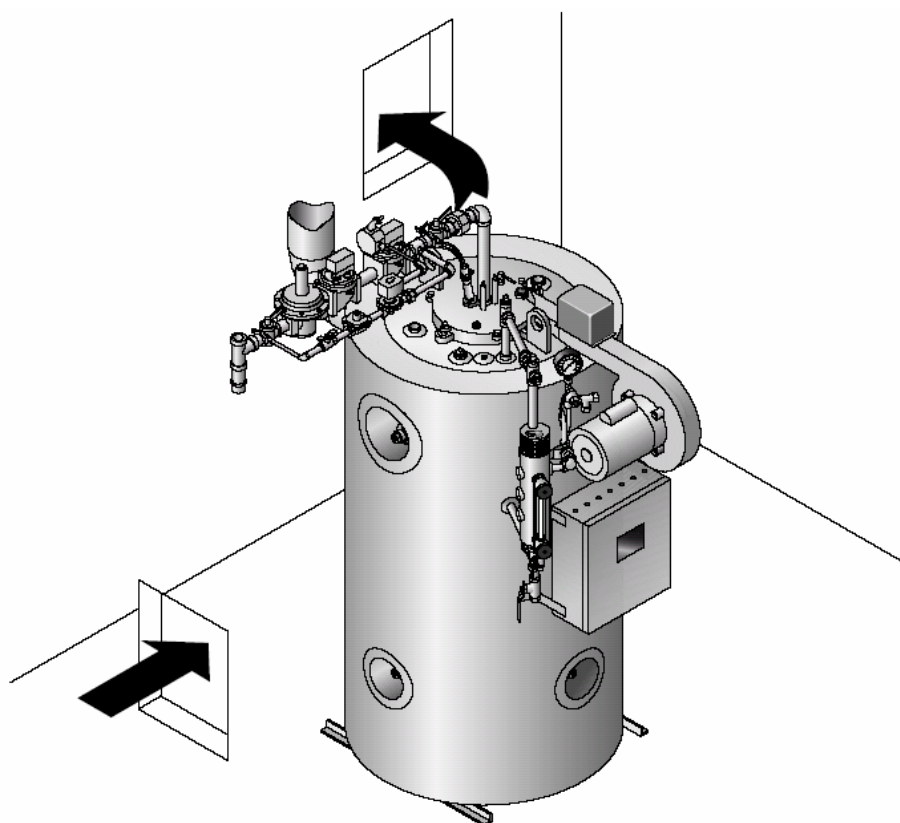
BHP	BT ²	M ²
4	1	0.09
6	1	0.09
10	1	0.09
15	1.5	0.14
20	4	0.37
30	4	0.37
40	5	0.46
50	5	0.46
60	7.5	0.69
80	12.5	1.11
100	16	1.49
130	20	1.86
150	23.5	2.19

Be sure total BHP --- air opening size. For instance if you have three 10 BHP boilers, it is a total BHP of 30, and the 30 BHP make up air opening size is 0.37 M² recommended.

NOTE

These measurements are subject to local regulations. The installation of exhaust fans in a boiler room is not recommended. An exhaust fan, or similar equipment can create

down draft in the stack or restrict the burner's air supply which will result in poor combustion. It is essential that only fresh air is allowed to enter the combustion air system. Foreign substances, such as combustible volatiles and lint, in the combustion system can create hazardous conditions.



Description/Instruction

Conventional Venting (in accordance with the local fire prevention and control code)

a) The stack should rise continuously to the connection with the chimney, and should contain no more than two bends at 45 angles or less. If required as the result of space limitations, one 90 elbow can be fitted at the back of the boiler. There should be two feet of straight, horizontal flue before any bends or turns. Any alternative stack arrangement must supply $-.02$ $-.04$ " W.C. pressure burner off.

b) The total horizontal run of the boiler stack should not exceed 25% of the total vertical rise. Except for the condition as a), the horizontal flue should be avoided, and the horizontal total pipe length must be no more than 4 feet.

c) The stack and chimney must be constructed from material that is rated for 532 degrees C operating temperature. Check all local codes for exact requirements.

d) Adequate provision must be made for the support of the weight of the chimney and stack to avoid having too great a load imparted to the flue outlet connection of the boiler.

e) The proper flue size and draft control is most important for proper burner operation. The flue must be as large or larger than the outlet on the boiler. Avoid flue piping too long and elbows too much by placing the boiler as close as possible to the chimney.

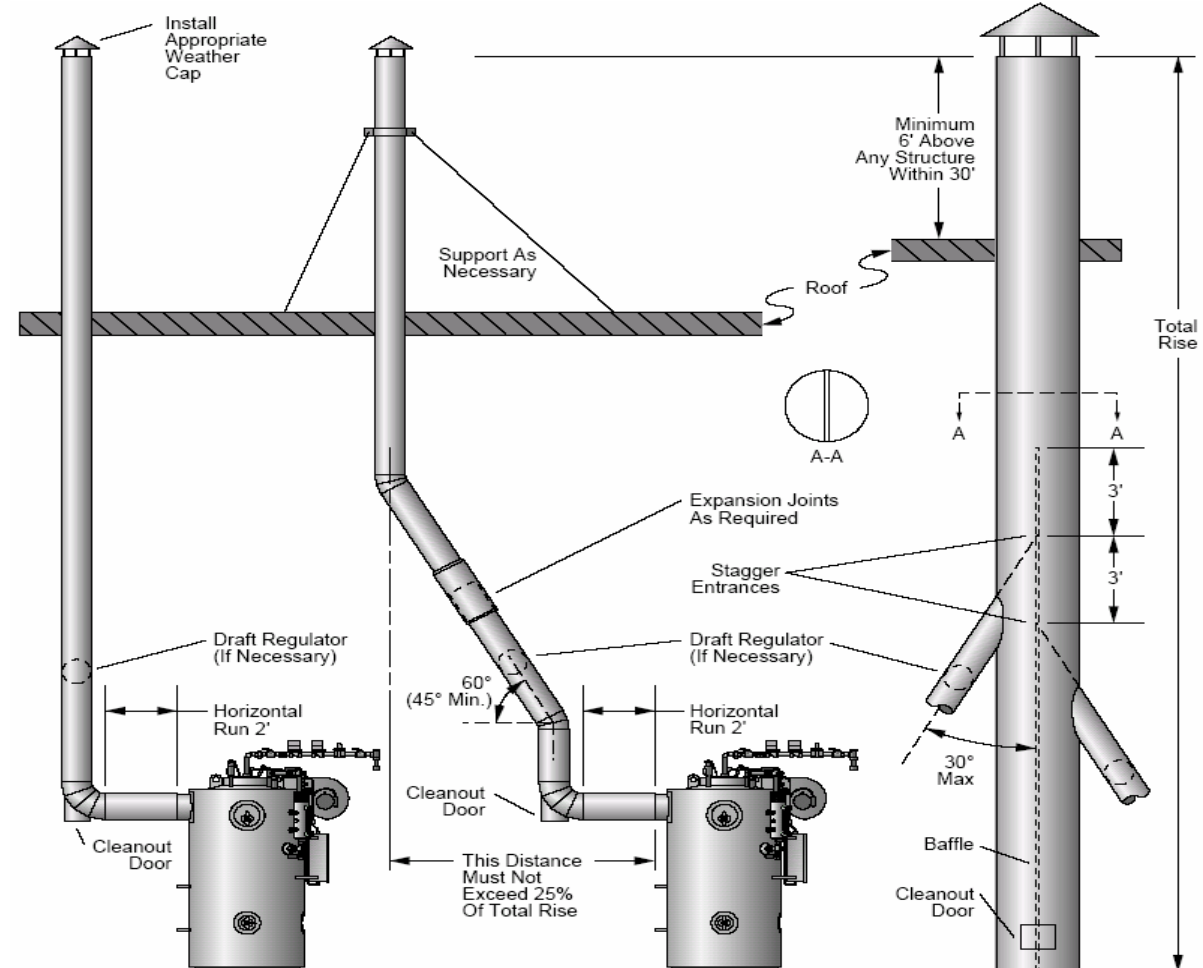
f) A mechanical draft regulator may need to be installed in the flue outlet. Do not install the draft

regulator prior to the first turn of the flue.

g) The installer should check the draft with a meter at $-.02$ $-.04$ " W.C. pressure with the burner off, and $-.04$ to $-.06$ W.C. pressure with the burner on.

BHP Boiler Flue Size

	Inches	Millimeters
4	6	152
6	6	152
10	6	152
15	8	203
20	10	254
30	12	305
40	12	305
50	12	305
60	12	305
80	14	356
100	14	356
130	16	400
150	16	407



Description/Instruction

Exhaust Side Wall Venting (In accordance with the local fire prevention and control code)

Boilers for which sidewall venting may be utilized are Town gas, propane gas, natural gas, or combustion oil and natural gas, sizes 4 to 30HP. The following criteria is required for installations using sidewall venting.

1) Flue vent piping shall be pitched upward at 1/4" per foot of length.

2) A U.L. approved draft fan must be installed to provide sufficient draft of -0.02 and -0.04 " W.C.

pressure to safely vent the products of combustion.

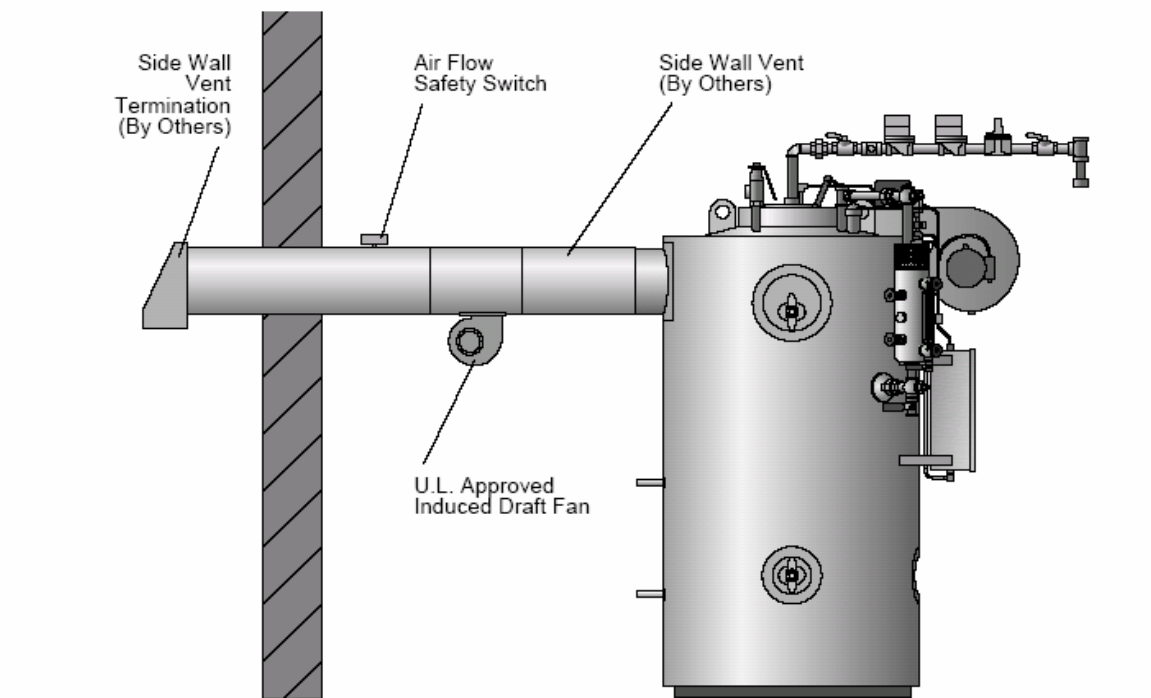
3) The draft fan should be located as close to the flue outlet as possible.

4) Draft regulation sufficient to lower the draft to between -0.02 to -0.04 " W.C. pressure may be required. The draft regulator(s)

must be between the boiler and draft fan.

5) The draft fan shall have an air flow proving switch wired in series with the boiler air safety switch.

6) The sidewall venting total length from boiler exhaust to termination shall not exceed 35 feet (10.7 m) with 4 elbows maximum.



Description/Instruction

Combustion Air Intake (In accordance with the local fire prevention and control code)

This shall be applicable only for gas fired vertical units, sizes 4-30 boiler horsepower. The following criteria are required for installations using combustion air intake assemblies.

- 1) Outside air intake inlet shall be equipped with a vent cap in order to prevent flame blow out from excessive wind. This vent cap shall have a minimum cross sectional opening equal to an 8 inch vent pipe.
- 2) All intake ducting shall have a cross sectional area equal to or greater than 50 square inches.
- 3) A mesh screen shall be affixed to the air inlet with openings of approximately 1/2" x 3/4".
- 4) The total length from outdoors to the boiler intake shall not exceed 35 feet (10.7 m) with four elbows maximum.

Corrosion of flue pipe

a) In the case of a combustion flue pipe, acid may develop over a long period of time per the following process. Chlorine containing gases, such as halocarbon refrigerants, carbon tetrachloride, trichloroethylene, when drawn into combustion air are broken down into elemental chlorine gas which exits up the flue pipe. If the flue pipe is cold, as it would be if the combustion process had been off for some time, the water vapor condenses in the flue pipe during the first few minutes of ignition and the chlorine in the combustion gas dissolves in the water forming hydrochloric acid. As the

combustion system flue line increases in temperature, the water vapor no longer condenses because the flue temperature is above the dew point of the combustion gas. The combustion gas then dries out (dehydrates) the hydrochloric acid solution leaving behind dry chloride salt.

b) When the next cold start-up occurs, the process repeats except that more and more chloride collects and concentrates along the flue. As the quantity of chloride increases it does not dehydrate completely as the flue heats up and a corrosive poultice develops which attacks the steel and will also attack the boiler.

c) Concentration levels of only a few ppm of chlorine containing compounds in combustion air can produce serious corrosion over long periods of time. High chlorine containing compounds such as carbon tetrachloride or perchloride would be prime suspects.

Installation Check Points

- 1) Make sure all piping connections are complete and tight.
- 2) Make sure the pressure controls are adjusted properly.
- 3) Make sure all electrical connections in the control panel box, the water column, and elsewhere are secure.
- 4) Make sure the door in the boiler room is closed. Combustion air contaminates can cause damage to the boiler jacket and stack.

NOTE

After installation is complete and prior to operation the pressure vessel should be cleaned.

Cleaning the Pressure Vessel

- a) After the boiler has been

installed and before it is placed in service it is advisable to purge the pressure vessel of any oil film, dirt, or other impurities. Clean the pressure vessel as follows:

- 1) Isolate the boiler from the system by shutting off the main steam valve.
- 2) Remove the steam safety valve.
- 3) Mix washing soda with water and pour it in- to the boiler through the steam safety valve opening.
- 4) The mixture of washing soda to water is as follows:

Boiler Size	Soda
4-6	454g
10-15	908g
20-30	1362g
40-50	1589g
60	1816g
80	2270g
100-130	3178g
150	4250g

- 5) Replace the steam safety valve.
- 6) Fill the boiler with water. Water column is about center in the water gauge glass.
- 7) Generate 15 PSI (1.054kg/cm²) of steam and shut off the boiler. Allow this hot solution to remain in the boiler for 10 minutes.
- 8) Drain and flush the boiler twice with fresh water.
- 9) To remove all the oil and dirt from the main steam and the condensate return lines, allow the returns to go into a floor drain or a safe discharge point for the first week of operation.

CAUTION

Do not store halogenated

Description/Instruction

hydrocarbons near or in the boiler room.

In general, ensure that the boiler area is in conformance with established boiler room

requirements. Review local codes.

As a final checkpoint, again, water treatment.

Here we emphasize the importance of proper water

treatment. Water analysis should be made by a competent water treatment concern and their recommendations should be followed.



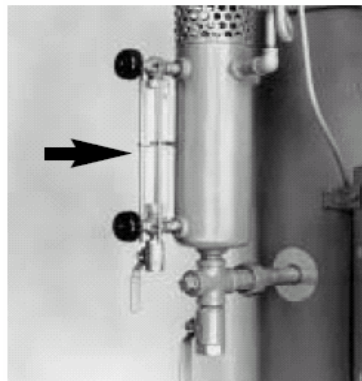
1) Shutting off the main steam valve



2) Remove the steam safety valve



3) Inject soda water



4) Make boiler water level at the position
Of arrow



5) Keep boiler pressure for 10
minutes at 15PSI

3

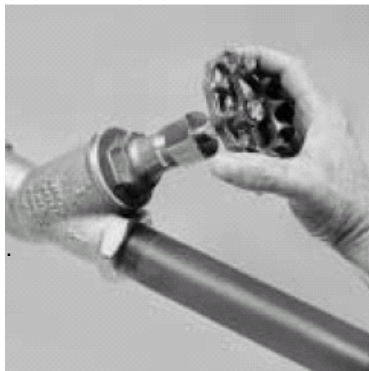
Starting the Boiler

Stop! Make sure you have read any followed all previous safety information. Consult with local authorities where approval for start-up is required.

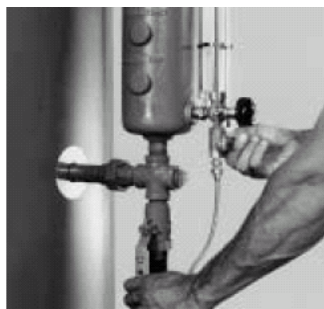
In general, ensure that the boiler area is in conformance with established boiler room requirements. Review local codes.

Carry out the following procedure on the initial start up of the boiler and on every subsequent occasion when restarting the boiler after a shut down.

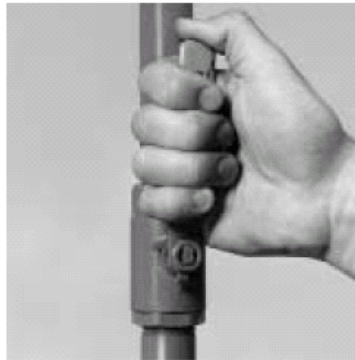
1. Close the blow-off valve.



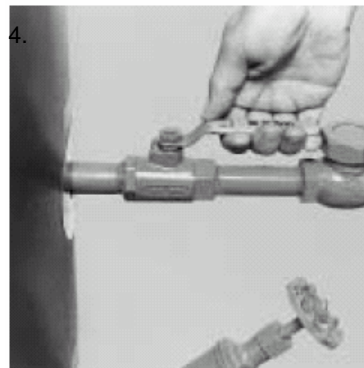
- 2 Close the water gauge drain



3. Open main steam stop valve at the top of boiler.



4. Open the water feed valve on the boiler.



5. Open valve on makeup water line to return system is used.



6. Place feed water pump fused switch the "on" position.

NOTE

a) The fused disconnect switch that controls the feed water should be kept in the "on" position at all times during the boiler operation as

well as during the non-operating period of the boiler.

b) This switch should be turned "off" only when repairs or adjustments should be made.

NOTE

The pump will continue to operate until the water reaches the correct level in the boiler. This level is approximately the center of the water gauge glass.

- 7 Activate the boiler power on switch, located on the side of the panel box.

8. With the unit full of water the low water safety relay(s) will be in a lock-out mode. Press the low water safety relay manual reset button located on the side of the control panel box.



Oil Burner Set Up

a) Open the oil line shut off valves.

b) Switch on the main power to the burner. Depress the manual reset button on the panel box.

c) To start the burner, turn on the switch located on the panel box. The blower motor will now start to deliver the air into the furnace. After the blower starts about 7 to 30 seconds, the magnetic oil valve is energized allowing the oil pump to deliver fuel to the furnace where it is ignited.

d) On Fulton 4-10 HP oil fired boilers, the burner control sights the fire from a cadmium sulfide photocell located on top of the burner. If it does not detect the flame in approximately 15 seconds, it will go out on safety lockout and shut down the burner.

e) On Fulton 15-150 HP oil fired boilers, the flame safeguard control sights the fire from an ultraviolet scanner located on top of the burner. There will be a first stage pilot before the main oil valve is energized. After flame is proven the main oil valve will come on. If flame is not proven, it goes into safety shut down.

Note:

4-20 BHP have only one stage. 30-150 BHP have two.

f) Reset by depressing the button on the flame safeguard control. If boiler does not respond after 3 attempts, contact your authorized Fulton Representative.

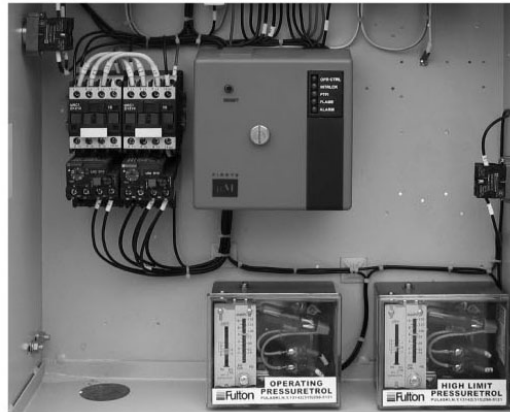
g) The main air control shutter is adjacent to the oil pump and should be adjusted so as to give a clean burning fire without excess air being delivered to the burner.

h) The secondary air control is an L type handle located on the top of the burner scroll which controls the amount of the air that is delivered over the oil nozzle. This should be adjusted to keep the fire from backing up into the blast tube.

i) Make sure the secondary air damper is locked.

j) Lock into position the main air control shutter.

k) After the oil has been ignited in the burner, it will be controlled through an on/off cycle by the pressure control in the panel box which should be adjusted to suit the boiler application.



15-60HP Fuel Oil/ Gas MEC230 series Control panel



15-60HP Fuel Oil Siemens series Control panel



80-100HP (Left) /130-150(Right) Fuel Oil Siemens series Control panel

Gas Burner Set Up

a) Open the manual gas cocks on the pilot and main lines of the gas head.

b) Switch on the main power to the burner. The water level relay is equipped with a manual reset. Depress the button on the box.

c) The flame programmer is the main control in the panel box. The programmer in conjunction with a sensing device, either a flame rod or a UV scanner, "supervises" the ignition sequence - proves the flame is satisfactory, and finally "monitors" the established flame. Should any fault occur, either during the ignition sequence or during normal running, the programmer will immediately go to "lock-out" and the burner will shut down.

d) When the pilot flame is established, the flame rod (or ultra-violet scanner) senses the voltage which is created in the flame between the flame rod and the gas nozzle (ground). This signal is transmitted back to the flame programmer which opens the main gas valve giving a main flame.

e) Fulton 4 - 30 HP. natural gas fired boilers can be equipped with flame rods or UV scanners.

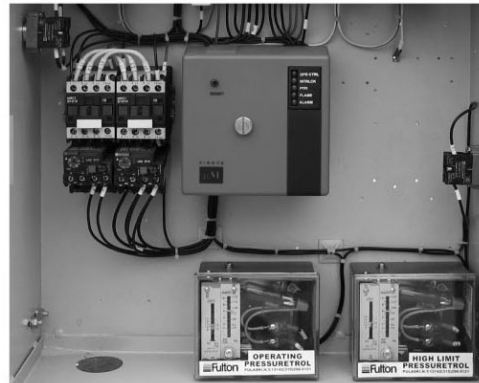
f) All Fulton propane or butane boilers and more than 40HP Fulton natural gas boilers are standard furnished with UV Scanners.

g) If the installation is new or the burner has been disassembled, the burner may not fire at the first attempt due to air which must be purged from the gas lines. This will result in the burner flame programmer going to lockout. Repeat the procedure for starting the burner.

h) The main gas valve will remain open as long as there is a demand for heat and the flame is carrying a sufficient signal to the flame programmer.

i) If the flame is not established at the start, the safety switch in the flame programmer control will open the contacts and shut off the burner.

j) Push the reset button on the control to reset. If trouble persists, it may be necessary to check the flame rod setting or the UV scanner. See Maintenance Section 4 for procedure to check flame rod setting or UV Scanner.



15-60HP Fuel Oil/ Gas MEC230 series Control panel



15-60HP Fuel Oil Siemens series Control panel

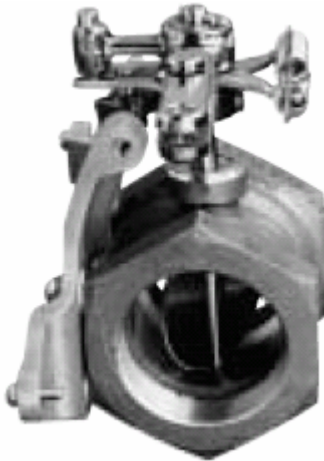


80-100HP (Left) /130-150(Right) Fuel Oil Siemens series Control panel.

Gas Burner Set Up For Boilers Equipped with Modulation

a) Modulation is available as an option on Fulton gas fired steam boilers for 30-150 HP units only.

b) Boilers equipped with modulation will have the linkage rod disconnected between the modulation motor and the gas butterfly valve for shipment.



c) Mount the gas train on the pipe nipple of the burner plate with the gas train inlet directly facing over the panel box. Reconnect the linkage from the butterfly valve to the modulation motor.

d) The end of the linkage arm that attaches to the butterfly valve will have a notch on both sides of it, where the swivel collar should be centered. This setting was based on factory test fire conditions.

e) Combustion analysis should be done at the installation to make any changes to insure proper combustion characteristics.

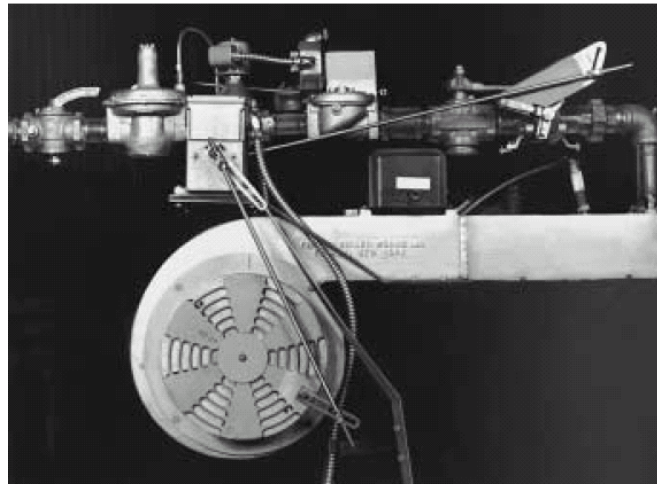
f) The modulating burner will have a modulation lock switch in the panel box to enable you to lock the firing sequence anywhere along the firing rate from low to high.

g) Depending on the combustion characteristics, it may be necessary to adjust both linkage arms. To adjust the linkages, unscrew the swivel collar and move the linkage rod in the appropriate direction.

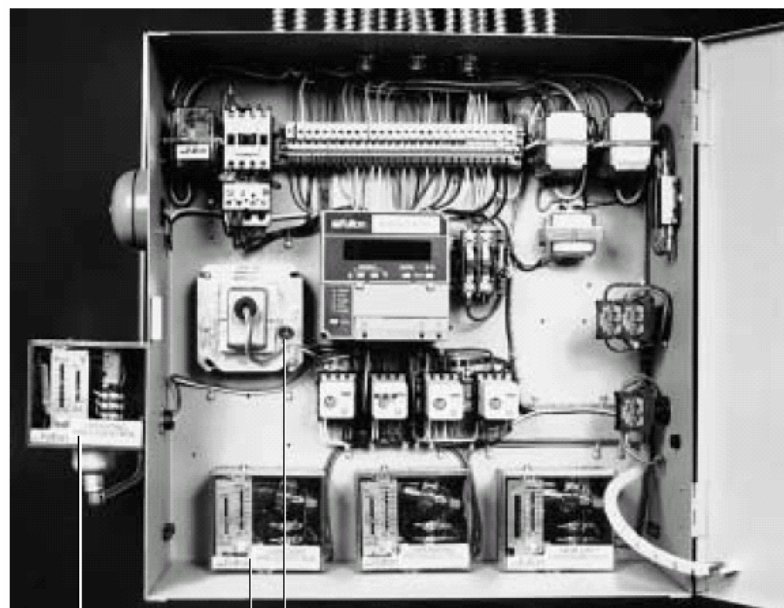
h) Modulating burners will have a proportioning pressure control in

addition to the standard operating pressure control that will send a 0-135 ohm signal to the modulation motor to adjust the firing rate. Both pressure controls should have the same setting.

i) NEMA 4 units will use a digital pressure controller with transducer as the operating pressure control which sends a 4-20 mA signal to the modulation motor to control firing rate.



Modulating Gas Fired Burner



Modulation Hold/Lock Switch

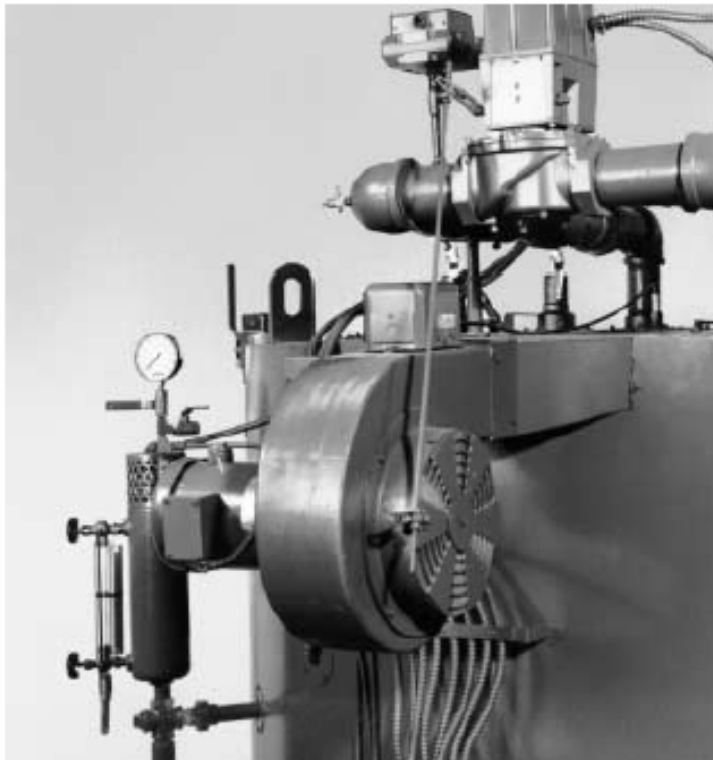
Night Heating Pressure Control (Optional)

Proportioning Pressure Control

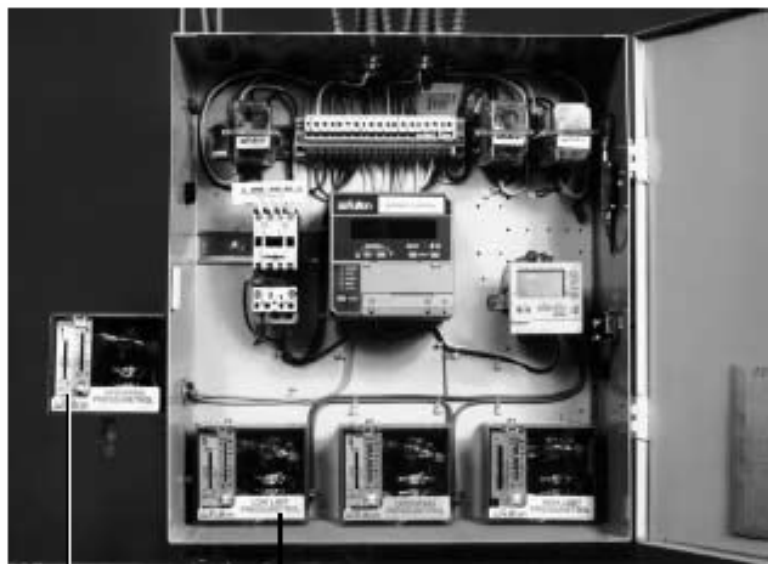
Panel Box for Modulating Gas Fired Boilers

Gas Burner Set up for Boilers Equipment with High-Low-Off

- a) A gas fired burner equipped for high-low-off firing is available as an option on Fulton gas fired steam boilers for 30-150 HP units only.
- b) Boilers that have a high-low-off firing rate have a linkage between the high-low gas valve and equipped with a spring return.
- c) The linkage will be disconnected from the gas valve shipment.
- d) Mount the gas train on the pipe nipple of the burner plate with the gas train inlet directly facing over the panel box. Reconnect the linkage from the primary air gate to the high-low gas valve.
- e) The end of the linkage arm that does to the gas valve will have a swivel collar should be centered. This setting was based on factory test fire conditions.
- f) Combustion analysis should be done at the installation to make any changes to insure proper combustion characteristics.
- g) To adjust the linkage, unscrew the swivel collar and move the linkage rod in the appropriate direction. The high-low-off configuration comes with two operating pressure controls.
- h) Set the low operating pressure control to approximately 60% of your desired set point and the main operating pressure control to your desired set point.



Gas burner equipped with high-low-off firing



Low fire Pressure Control
Night Heating Pressure Control (Optional)
Panel Box for Boilers equipped with high-low-off firing

Warning

Prior to the commencement of any work requiring the removal of cover plates and the opening of the control panel box, the electrical supply to the boiler must be disconnected .

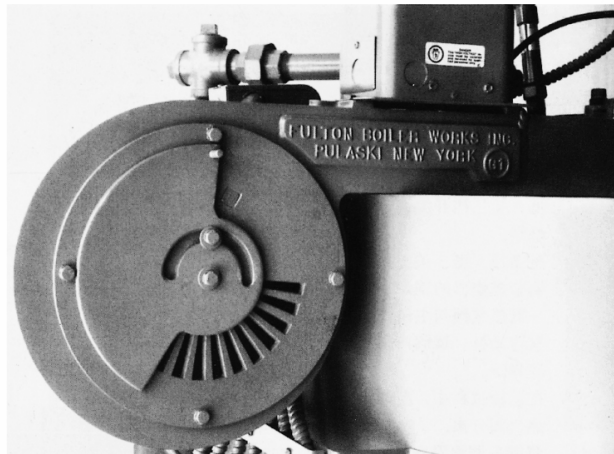
Primary Air Adjustment for Fulton Gas Fired Steam Boilers

a) The primary air adjustment or main air control is located at the fan housing face. This control is used to supply the burner with excess air needed to facilitate good combustion. Too much or too little air will result in poor combustion. It is important to make sure the lowest level of excess oxygen is present while still maintaining a high level of carbon dioxide and negligible carbon monoxide. Using a CO₂ or O₂ tester it is possible to determine the percent of excess air in the combustion mixture.

b) On a No.2 oil fired boiler the excess oxygen should be 4 percent with 11 percent carbon dioxide. A smoke test is the best means to check for combustibles in the flue gases. A smoke test of 0-2 is an acceptable level. It is best to measure the flue gas with the stack in excess of 216 degree of C. To increase the oxygen in the burner open the air adjustment to the right. To close or reduce the secondary air, move it to the left.



Secondary Air Adjustment for 4-20HP



Primary Air Adjustment Is Located At Fan Housing Face

Secondary Air Adjustment Procedure For Fulton Gas Fired Steam Boilers

a) The secondary air control adjustment is located on the top, right hand side of the burner assembly. This damper type air controller is used to introduce air to and through the blast tube of the burner. The purpose of the primary air adjustment is to proportionately divide the air to the center or outer fire chamber.

By moving the damper closed, the air is forced to the outside of the fire chamber with less air going down the blast tube area. By pulling the damper open more air is forced down the blast tube and less on the outside wall of the deflector face and fire chamber.

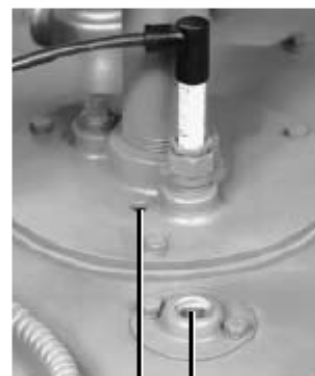
It is important in the combustion process to maintain proper air mixtures between the outer surface

and center of the blast tube area. On most boilers the damper is locked in a wide open position. However, if it is necessary to close the damper, care should be taken to close the damper slowly and no more than 1/4 of the distance of the swing of the damper assembly.

b) A visual examination down the blast tube should reveal that no heat, flames or fumes are backing up through the burner plate area. If they are the damper must be opened up once again. Failure to remove the flame or gases from the blast tube area will result in severe backfires as well as cause premature failure of electrodes, flame rods, and other burner components.



Secondary Air Adjustment for 30-150HP

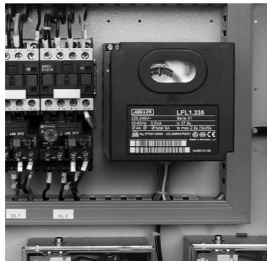


Burner Viewing Port
Blast Tube Viewing Port

c) A visual inspection down the view port should also show the fire completely covering the furnace walls. If the fire is tunneling down or is not to the outside wall of the furnace, the efficiency will drop off. Close the secondary air damper until tunneling stop.

Boiler control

a) Flame Safeguards/Burner Control—this is the main control in the panel box. The programmer in conjunction with a sensing device (flame rod or an ultra violet scanner) “supervises the ignition sequence—proves the flame is satisfactory—and finally “monitors” the established flame. Should any fault occur, either during ignition sequence or during normal running, the programmer will immediately go to “lock-out” and the burner will be shut down.



b) Low Water Cut-off--probe type—Cuts off the units when water level is too low after a 3second time delay to avoid nuisance shut downs. As a standard feature, Fulton boilers are equipped with ASME CSD-1 code controls which include a manual reset feature on the burner low water cut off relay and ASME CSD-1 Code controls also feature an independent second low water reset button and the boiler will start.



CAUTION

Do not tamper with the safety features of the water safety cut out.

c) **Pressure Relief Valve**—limits maximum operating pressure of the boiler.

d) **Operating Steam Pressure Control**—located in the control panel box and connected to the steam pressure gauge assembly by means of a copper tube. The pressure control regulates the on/off cycle of the burner, shutting the burner off when maximum pressure is reached and switched on when the steam pressure falls below a predetermined level.



e) **Sight Glass Isolation Valves**—The brass sight glass isolation valves are equipped with an internal ball check. In the event that a sight glass should break, the ball will seat, preventing the discharge of steam and water. The brass valve stem must be opened fully to enable this feature. If the valve is in any other position than full open, the ball will not seat. For added safety all Fulton boilers are equipped with gauge glass protectors.



f) **High Limit Pressure Control**—located in the control panel box and connected to the steam pressure gauge assembly by means of a copper tube. The pressure is usually set 10-15PSI (about 0.703-1.054kg/cm²) above the operating pressure, but below the maximum pressure of the pressure relief valve. If the pressure exceeds the high limit pressure control setting, the boiler will automatically shut off. The high limit pressure control must be manually reset depressing the plunger located on top of the control. (The reset -type controller is optional.)



g) **Air Pressure Switch**—mounted on the burner scroll, this switch is operated by the pressure of air entering the burner through the throat of the scroll. Absence of air, or insufficient pressure, will prevent the switch completing the circuit, thus preventing the burner from operating.



preventing the burner from operating.

CAUTION

When stopping the boiler for any extensive repairs, shut off main disconnect switches on both the boiler side as well as the feed

water side.

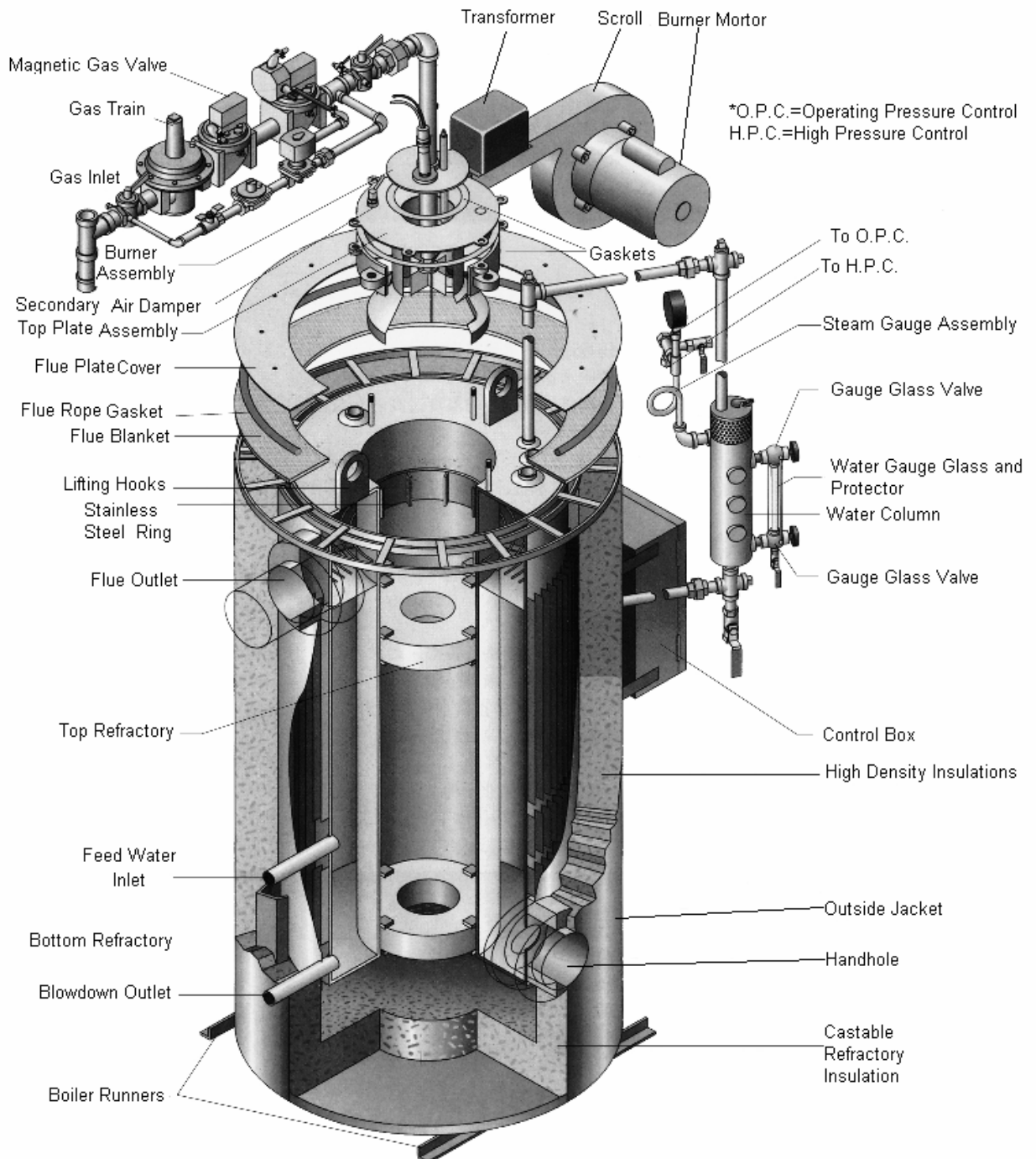
NOTE

To ensure that your Fulton Steam Boiler is kept operating

safety and efficiently, follow the maintenance procedures set forth in section 4 of this manual.

4

Maintenance



NOTE

To ensure the continued safety efficiency of the boiler, the schedule of maintenance outlined in this section should be adhered to.

WARNING

Prior to the commencement of any work requiring the removal of cover plates and the opening of the control panel box, the electrical supply to the boiler must be disconnected.

Procedure for Cleaning Water Probes

Clean probe on top of boiler shell and probes in water column. Make sure there is no pressure on the boiler during the removal of the probes. Remove one probe, clean with very fine emery cloth and replace it before removing another to assure no probe mix-ups that would change the control functions. For replacement purposes, installed probe lengths are indicated in the chart below. For a universally



adaptable plug and probe which can be cut to length in the field to fit all boilers.

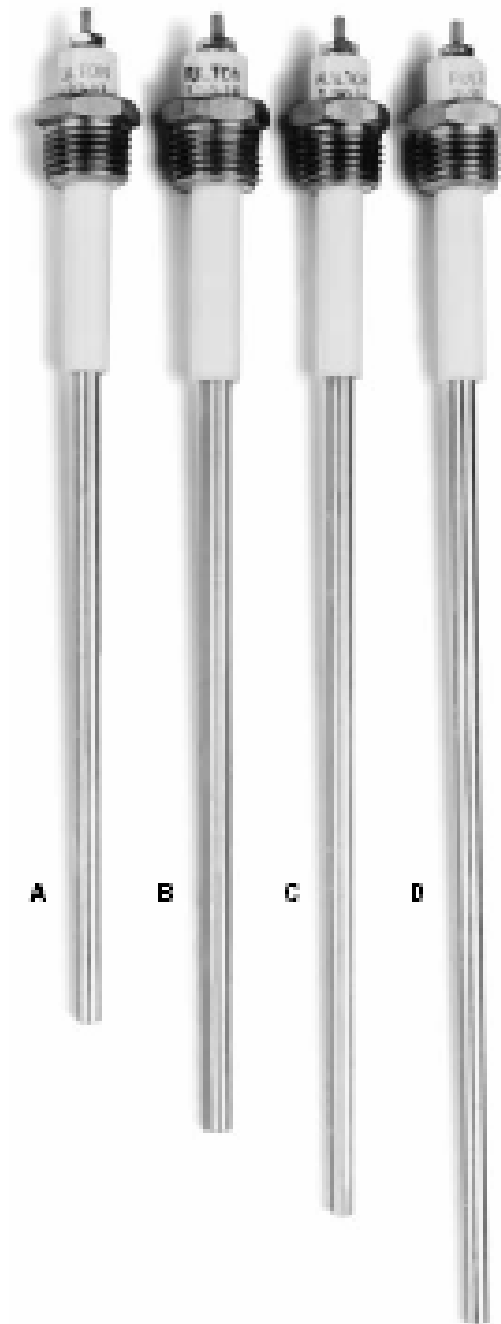
*A=7-1/4"—184mm

*B=9-1/4"—235mm

*C=11-1/4"—286mm

D=17—1/8"—435mm

*For 4 HP boilers only, water column probes are 2" shorter.



Flame Rod Adjustment for Fulton Gas Fired Boilers

a) The flame rod adjustment is made by loosening the lock nut and turning the porcelain portion of the flame rod clockwise or counter clockwise. Whenever a flame rod is moved, care should be taken to ensure that the flame rod does not ground out by touching the metal surface of the blast tube assembly. A keyboard display module can be used to determine proper signal response. It is necessary to establish pilot so that the main gas valve will engage. The main flame should be adjusted to an acceptable flame signal to ensure continued performance. A poor signal will going off safety.

b) A single flame rod is used on 4-15HP Fulton Boilers and two flame rods on 20 and 30HP. If the boiler has two flame rods, adjust the flame rod in the burner plate first, with the outside one disconnected. After a good pilot signal is established on the inside flame rod, then the outside flame rod can be hooked up and the signal adjusted for proper responses.

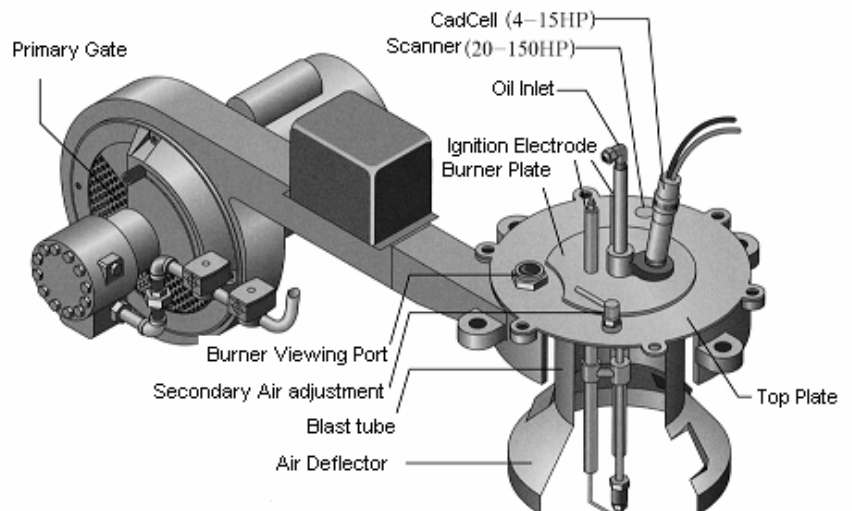
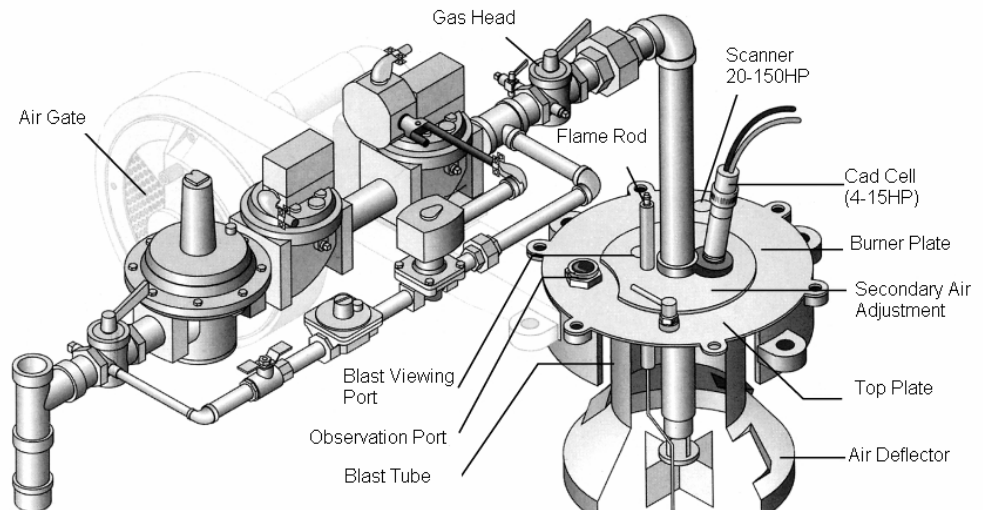
c) If a signal is erratic after adjusting the flame, the main and secondary air supplies may need adjusting. If a flame rod is cracked or broken, the porcelain will have to be replaced to get a proper signal.

Flame Scanner Adjustments for Fulton Gas/Oil Fired Steam Boilers

a) Flame scanner adjustments are made with the detectors installed and the burner running. It is essential to obtain optimum flame signal detection for safe and continual operation of the control relay.

b) If a scanner is inoperable, it may prove the detector is working and only an adjustment to the pilot flame is needed to improve the signal.

c) If the scanner is found to be defective, replace.



NOTE

The scanner is located on the outside edge of the burner top plate for 20-150 HP.

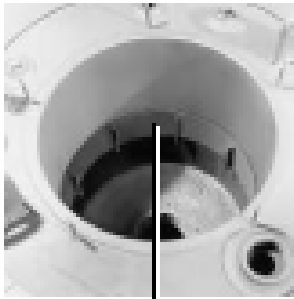
d) For the RM7800 series use a keyboard display module or voltmeter, the flame safeguard will require a 1.25VDC signal to pull in the main flame. Then a maximum signal should be obtained on main flame.(5.0 VDC)

e) Adjustments to establish a good signal may include the following items:

- 1) Primary and secondary air adjustments.
- 2) Increase the pilot gas through the pilot gas regulator.

Checking the Stainless Steel Combustion Ring for Fulton Gas Fired Steam Boilers

- a) The stainless steel combustion ring in Fulton gas fired boilers are designed to bring quick and effective flame transfer to the flame wall. The ring should fit securely and against the furnace wall for best results.
- b) The ring should be inspected for distortion in the event of poor combustion in the event of poor combustion which could result in flame failures



Stainless Steel Ring

Furnace Refractory Replacement Procedure

- a). Remove the burner plate and top plate assembly up and out of the scroll assembly.
- b) Remove the stainless steel combustion ring from the furnace.
- c) Remove the clean-out plugs from the bottom sides of the boiler. 4-15 HP boilers have one clean out plug located at the panel box. 20-60 HP boilers have one clean out plug located at the bottom of the boiler to the right side of the panel box. 80-150 HP boilers have two clean out plugs located at the bottom of the boiler to the left and right sides of the panel box.
- d) Break off the top holding clips that were to keep the refractory in position during shipping. The 4-50 HP boilers also have holding clips beneath the top refractory. There is no need to cut the holding clips located beneath the top refractory

as the refractory may be rotated to avoid these clips during installation of the lower refractory. The 60-150 HP boilers have welded flats bars beneath the top refractory. These bars will have to be cut to change the lower refractory and refitted as the top refractory is installed. For the lower refractory you will also need to break off the top holding clips that were used to keep the refractory in position during shipment.

- e) Break up the top and/or bottom refractories and remove the pieces from the through the clean-out plugs.

NOTE

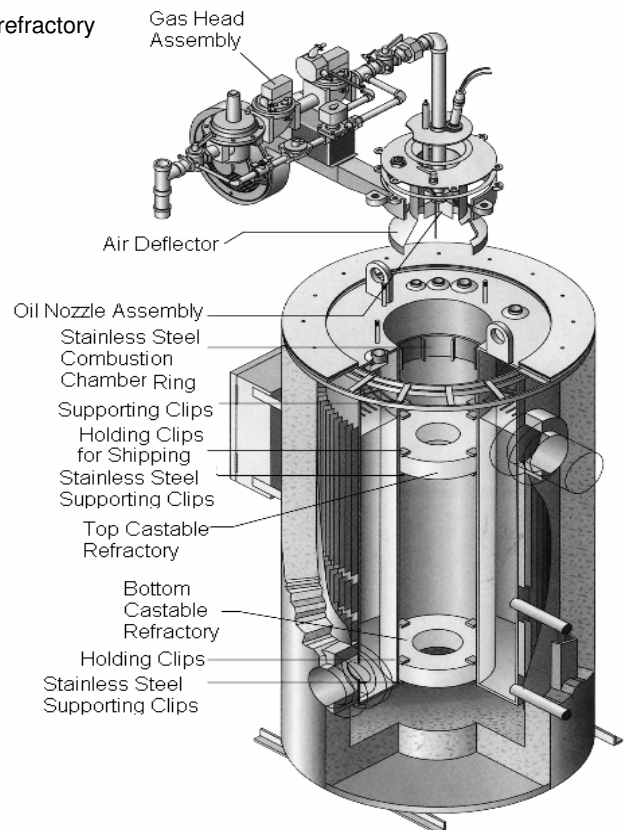
If only the top refractory is to be changed, the bottom refractory need not be broken.

- f) Round and bevel the outer edges of the new refractories.
- g) The bottom refractory has the largest hole, while the top refractory has the smallest.
- h) Lower the bottom refractory

down the furnace with wire fastened around the refractory in three positions. When the refractory is close to position, it can be tipped by maneuvering the wire to drop it flat on the holding clips. If the refractory will not tip, it may have to be removed and again rounded and beveled.

- i) Install the top refractory in the same manner as the bottom refractory. When installed the outer edges must be sealed with insulcrete- a castable refractory mix available from the Fulton factory. It is not necessary to reinstall the shipping clips.

- j) Install the stainless steel combustion ring, burner assembly and clean out plug.
- k) Normal operation can be resumed immediately.



Maintenance

Recommended Daily Maintenance Schedule

a) The following procedures should be carried out daily. They are designed to prevent the build up of scale, silt, or sludge in the bottom of the boiler and in the pipes leading to the water gauge. In addition to these procedures, the advice of a water treatment supplier should be sought and followed.

b) Blow down the boiler each morning by starting the boiler and generating not more than 10 PSI(lb/in.2) of steam. Turn on tap water to blow-off separator, then open the boiler blow off valve for approximately 10 seconds, then close the valve. Shut off tap water to blow off separator.



Blowdown boiler daily ;shown is the blowdown "Y" Valve

NOTE

If the boiler is being operated automatically on a time clock, the blow off operation may be done once during the working day and once at the end of the day when at 10 PSIG or less.

c) Blow down water column each morning when boiler is at 10PSI by opening the water column and the water gauge blow off valves for approximately 5 seconds, then close the valves.



d) If the feed water is being treated by compounds, make sure that this treatment is carried out carefully and according to the manufacturer's instructions.

NOTE

Fulton recommends that the water treatment should be added between the pump and the boiler.

e) When first starting the boiler each day, make sure ignition and burner are working properly.

f) Check water level in sight glass.

g) Check to be sure feed water pump is working.

h) For float type water level control, blow-down float chamber.

Recommended Weekly Maintenance Schedule

Check that the low water cut-off relay is opening correctly in the following manner.

1) Make sure that the boiler is cool with little or no pressure showing on the steam pressure gauge.

2) With the burner operating, open the boiler blow off valve. When the water drops below the required level (note the level in the water gauge glass) the burner should shut off; this is when the water level falls below the low water electrode in the water column assembly and

/or the boiler shell. Manual reset of the low water relay is required.

Recommended Monthly Maintenance Schedule

WARNING

Make sure main power switch is off before starting work.

a) Clean the water gauge glass.

CAUTION

Do not clean the gauge or gauge glass while pressurized or in operation.

1) Clean the water gauge glass using a commercial non-abrasive glass cleaner. Use diluted acids such as hydrochloric (muriatic) acid when regular cleaners do not seem to work. Do not use wire brushes or any other abrasive materials which could scratch the glass. If any leakage is evident, replace the gasket.



Clean glass,replace gasket if leaking.

2) Fit the gauge glass protector for water level column.

b) Clean water pump strainers.

c) Check scanner or flame rod and ignition electrode.

d) Check starter contracts. Burned or pitted contacts should be replaced. Do not use sand paper or file to clean.

e) Clean water traps and strainers in fuel lines.

f) Check operation of all steam traps on condensate return system.

Maintenance

g) Remove brass pipe plug at the cross connection below water column and clean nipple into boiler. Boiler must be cold and water level below pipe.



Recommended Semi-Annual Maintenance Schedule

a) Cleaning the gas burner assembly

1) Oil : Clean fan blades; oil the motor. Replace the fuel oil filter and clean the oil pump strainer. Remove ,clean and adjust the oil nozzle and the electrode assembly.
2) Disconnect the gas head from the burner by disconnecting the union. Remove the burner plate screws. For 4-15HP boilers with scanner, disconnect scanner from burner plate. If using flame rod, then check the equipment, reset the burner assembly and check the setting of flame scanner.

3) Check the combustion efficiency of the burner and adjust if necessary.

4) Clean probe on top of boiler shell and probes in water column. These must be no pressure on the boiler during the removal of the probes.

5) Check refractories for soot or breakage and inspect the stainless steel ring.

6) With the boiler under no more than 15PSI pressure, check that the steam safety valve is operating by lifting the lever.

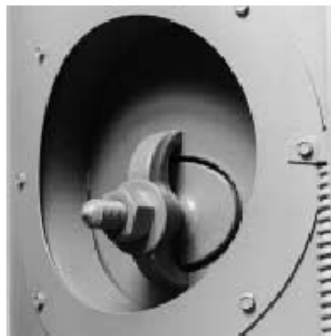
b) Drain condensate tank and clean tank by flushing with hose. Check float valve operation.

c) Check electrical controls and motors for correct operation.

d) Check water pump for correct operation.

e) Shut off the boiler completely and drain.

f) Remove the hand holes and inspect the interior of the vessel for scale or sludge deposits. The amount of deposits will indicate the efficiency of the water treatment being used. The frequency of the inspection will depend on the condition of the water side of the boiler.



Inspect hand holes for scale or sludge buildup.

g) Replace hand hole gaskets using the following procedures:

1) Remove the hand hole assembly using a 1-1/4" tee handle wrench or drive socket wrench.



2) Remove the old gasket and thoroughly clean the surface on the boiler and the plate.

3) Fit the hand hole assembly as follows:

a) Place the gasket on the hand hole plate and ensure that it is seating correctly. Do not use any grease, lubricant, or adhesive.

b) Position the plate in the boiler. Set the yoke and tighten the securing nut sufficiently enough to provide a snug fit. Verify the position of the plate in the boiler,

then make it hand tight and then snug with wrench about 1.4 turn. Do not compress excessively.

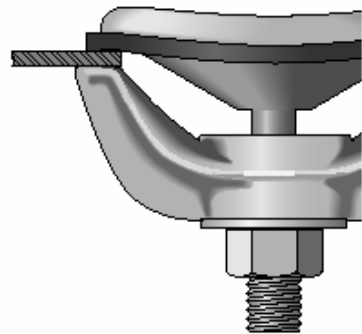


Illustration shows correct pressure on gasket.

c) If the gasket leaks while pressure is being built up, tighten only enough to stop leakage. Never tighten more than necessary to prevent leakage. Excessive tightening may shorten the life of the gasket.

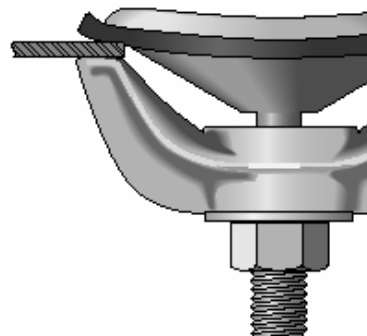


Illustration shows over compressed gasket.

d) Refill the boiler with fresh water.

NOTE

After a new Fulton Boiler has been in operation for several months, pieces of burned metal

Maintenance

will be found in the space at the bottom of the boiler. These pieces of metal are the remains of a light gauge metal form which was used during manufacture for forming the boiler insulation. This is a normal condition and does not affect the efficiency or the life of the boiler in any way.

Recommended Annual Maintenance Schedule

a) Repeat the "recommended semi-annual maintenance schedule"

b) Dirty flues can cause air flow restrictions resulting in poor combustion and loss of efficiency.

Clean Flues as Follows:



Remove burner and flue cover plate

1) Remove burner and flue cover plate



Wire brushing the flue passages.

2) Wire brush flue passage.

3) Remove clean out plugs at lowest part of unit and clean the bottom of combustion chamber.



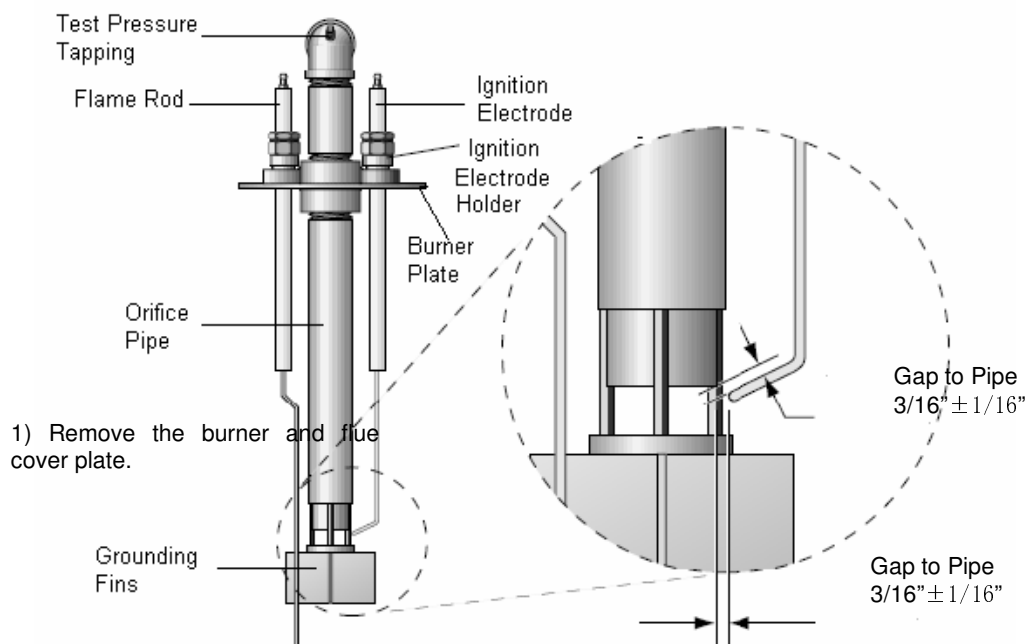
Removing clean out plugs.

4) Remove all soot from the top, and from the clean out plugs at the bottom with a vacuum cleaner.

5) Replace clean out plugs carefully so as not to damage insulation and replace burner and flue cover plates.

c) Flush boiler out if necessary. See Section 2 for proper procedure for "Cleaning the Pressure Vessel".

d) Provide annual inspection by a qualified inspector.



Trouble shooting

a) The following trouble shooting guide will assist in the diagnosis and the correction of minor field problems . It contains instructions and isolate possible troubles which occur during normal operation. It should be used in conjunction with the wiring diagram.

b) The following lists the most common troubles that may occur on the Fulton oil fired boilers. Refer to left hand column of the chart to locate the problem. Determine which cause, listed in the center column, That presents the problem by performing the corrective action as listed in the right column titled "REMEDY".

Troubleshooting for steam boilers

Problem	Cause	Remedy
Ignition Failure	1. Power Supply	check fuse or circuit breaker. Reset or replace, as necessary.
	2. Ignition Electrodes	Check electrodes for carbon built up and clean if necessary. Check for proper adjustment. Readjust if necessary. Check for cracks in porcelain. If found, replace.
	3. Transformer	Check voltage between transformer leads at terminal block to be sure transformer is being powered.
	4. Cad Cell	Check for ignition interference.
	5. Flame Safeguard/Burner Control	Check voltage between pilot terminal neutral and ignition terminal neutral. Check must be made before control locks out on safety. If no power, replace control.
	6. Oil Nozzle Clogging	Check oil nozzles and clean or replace as necessary.
	7. Gas Valve Sticking (pilot)	Check for dirt in valve or orifice and clean if necessary. Check for faulty actuator or valve and replace if necessary.
Flame Failure	1. Oil Supply	Check oil level in supply tank to be sure it is not below intake line. Fill tank with oil. Check for clogged nozzle. Clean or replace. Check oil filter and replace if necessary.
	2. Gas Supply	Check for gas pressure and for intermittent supply problems. Gas pressure for natural gas should be 3-1/2" W.C. plus fan pressure at the elbow to the burner and 7" to 11" W.C. at the head of the train.
	3. Ignition Electrode	Check electrodes for carbon build up and clean if necessary. Check for proper adjustment. Readjust if necessary. Check for cracks in porcelain; if found, replace.
	4. Primary Air Adjustment	Check air adjustment. Air may be blowing flame away from flame sensor.
	5. Oil Valve	Check voltage between oil valve natural at terminal block to be sure oil valve is getting power.
	6. Oil pump	Check for clogged strainer or filter. Remove and clean. Check for slipping or broken coupling. Tighten or

Continued

Problem	Cause	Remedy
Flame Failure	6. Oil pump	replace. Check for frozen pump shaft. Replace.
	7. Flame Rod Adjustment or UV Scanner	Check flame for carbon buildup and clean if necessary. Check flame rod adjustment via a display module. Flame signal should be 5VDC. Check for cracks in porcelain. If found, replace. Check for dirt on flame scanner and clean. Check for proper location of detector.
Burner Cut-off	1. Oil Supply	Check oil level in supply tank to be sure it is not below intake line. Fill tank with oil. Check for clogged nozzle. Clean or replace. Check oil filter and replace if necessary.
	2. Gas Supply	Check to be sure main gas cock is closed. Check coil in gas valve with OHM meter. Replace if faulty. Check gas regulator setting and readjust as necessary. Check inlet gas pressure and increase or decrease as necessary.
	3. Ignition Electrode	Check electrodes for carbon build up and clean if necessary. Check for proper adjustment. Readjust if necessary. Check for cracks in porcelain; if found, replace.
	4. Oil Nozzle	Check for clogged nozzle; clean or replace.
	5. Transformer	Check voltage between pilot terminal neutral at terminal block to be sure transformer is being powered.
	6. Cad Cell	Check for ignition interference. Check for too small of an orifice in scanner nipple.
	7. Flame Rod Adjustment or UV Scanner	Check flame for carbon buildup and clean if necessary. Check flame rod adjustment via a display module. Flame signal should be 5VDC. Check for cracks in porcelain. If found, replace. Check for dirt on flame scanner and clean. Check for proper location of detector.
	8. Air switch	Check for bad air switch by jumpering the two air switch leads at the terminal block. If the boiler starts and runs with these terminals jumpered, the air switch should be replaced.
Poor Combustion	1. Refractories	Check refractories to see if they are plugged with soot or broken in pieces. Clean or replace as necessary.
	2. S.S Ring	Check to be sure ring is present and fits tight against the furnace wall.
	3. Oil nozzle	Check for clogged nozzle. Clean or replace.
	4. Primary Air adjustment	Check air adjustment. Air may be blowing flame away from flame sensor.
	5. Secondary Air Adjustment	Check main air adjustment to see if it is loosened up. Adjust as necessary and tighten in position. Check for CO ₂ and O ₂ level.
	6. Oil Pump	Check for clogged strainer or filter.

Maintenance

Continued

Problem	Cause	Remedy
Poor Combustion	7. Draft	Check draft with a gauge. Draft should be a -0.02" to -0.04"W.C. with burner off or -0.04" to -0.06" when operating.
	8. Dirty flue	Check flue for carbon buildup or blockage. Clean flue passages with brush.
	9. Negative Room Pressure	Make sure no exhaust fans are running in the boiler room.
Burner Back Fire	1.Refractories	Check refractories to see if they are cracked or broken in pieces. Replace as necessary.
	2. Ignition Electrode	Check electrodes for carbon build up and clean if necessary. Check for proper adjustment. Readjust if necessary. Check for cracks in porcelain; if found, replace.
	3. Oil Valves	Check for leaking oil valves and replace.
	4. Draft	Check draft with a gauge. Draft should be a -0.02" to -0.04"W.C. with burner off or -0.04" to -0.06" when operating.
	5. Negative Room Pressure	Make sure no exhaust fans are running in the boiler room.
	6. Oil fittings	Check for all the inlet of oil fittings if there is air mixed, if found, tighten. Check if the inlet is limited, if it is, replace.
	7. Vacuum on Pump	Check for too high a vacuum on the pump. Check oil lines and distance from tank to boiler.
Boiler will not maintain pressure	1. Oil Supply	Check oil level in supply tank to be sure it is not clogged nozzle. Clean or replace. Check oil filter below intake line. Fill tank with oil. Check for clogged nozzle. Clean or replace. Check oil filter and replace if necessary.
	2. Oil Nozzle	Check for clogged nozzle. Clean or replace.
	3. Oil valve	Check if there is leakage.
	4. Oil Pump	Check if the filter is blocked.
	5.Gas Supply	Check gas pressure coming into gas train. If low, contact gas company. Should be 7" to 11" W.C. Check coil in gas valve with OHM meter. Replace if bad. Check gas regulator setting and readjust as necessary.
	6. Dirty Flue	Check flue for dirt buildup, clean the flue passages.
	7. Scale Built Up in Boiler	Call water treatment professional and consult Fulton company.
	8. Pressure Control	Disconnect all power to the controller. Disconnect the wires from the controller. Put an OHM meter between the switch terminals. Lower the set point of the controller. Switch should make. Raise the set point and recheck with OHM meter. Switch should break. If the controller operates improperly, replace it.
Boiler is surging	1. Steam traps blowing through	Check traps to see if they are clean or replace as necessary.

Maintenance

Continued

Problem	Cause	Remedy
Boiler is surging	2. Perc(cleaning solvent in boiler)	Clean boiler with washing soda per instruction manual.
	3. Scale build-up or lime deposits	Call water treatment professional and consult Fulton company.
	4. Too much compound in system (water treatment)	Dump return tank and flush system. Have water tested by water treatment company.
	5. Too much water softener (high PH)	Have water tested by water treatment company.
	6. Vapor locking of pump	Allow system to cool down, check steam traps and check to be sure return lines are not insulated. Check return tank temp. If it is above 82 degree of C, vapor locking of pump will occur. Inspect check valves. Clean and replace as needed. Replace pump with multistage centrifugal good for 121deg.C.
	7. Too much of a load	Check total equipment horsepower required against horsepower of boiler being used. Decrease amount of equipment being used at one time.
	8. Boiler new (not cleaned)	Clean per instruction in instruction manual.
Boiler Rumbles and Pulsates	1. Draft problem	Check draft with a gauge. Draft should be a -0.02" to -0.04"W.C. with burner off or -0.04" to -0.06" when operating.
	2. Too much primary air	Check primary air adjustment.
	3. Air or water in the oil	Check tank and lines for water and air.
Boiler pushing water with the steam	1. steam traps	Check traps. Clean or replace as necessary.
	2. Too much boiler compound	Dump return tank and flush system. Have water tested by water treatment company.
Pump will not cur off	1. Dirty Probes	Clean or replace as necessary.
	2. Relay failed	Make sure relay is plugged in tightly . If so, replace water level relay.
	3. Ground connection	Check for ground connection condition.
Pump runs but does not put water into boiler	1. Vapor locking of pump	Allow system to cool down, check steam traps and check to be sure return lines are not insulated. Check return tank temp. If it is above 82 degree of C, vapor locking of pump will occur. Inspect check valves. Clean and replace as needed. Replace pump with multistage centrifugal good for 121deg.C.
	2. Impeller adjustment	Check for impeller wear and adjust per component information in instruction manual.
	3. Back pressure on pump	The pump needs to be repaired.
	4. Plugged Feed water Nipple	Check and clean.
Water pump will not come on at times	1. Scale on probes	Clean and replace.
	2. Bad Pump Contactor	Check to see if contactor is being powered. Check to see if contactor coil is pulling in or if the motor turns while pump does not run, replace if necessary.
	3. Bad Pump Motor	Check the incoming power to the pump to be sure it is receiving power. If power is present but motor does not run , replace it.
Boiler Flooding	1. Pump does not shut off	Dirty probes. Clean or replace.
	2. Relay failed	Check for the contact surface , replace if necessary.
	3. Ground Connection	Check ground connection condition.

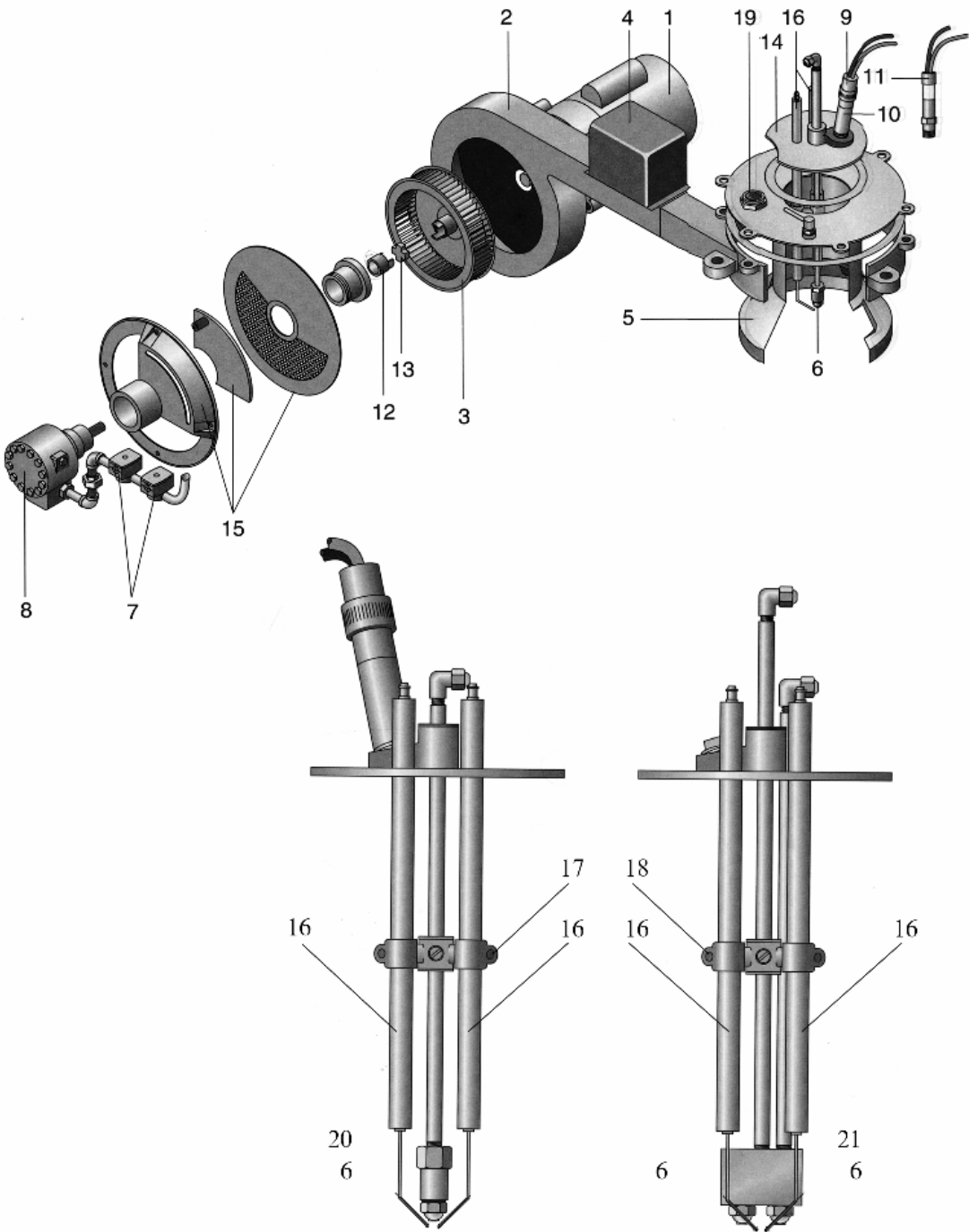
Maintenance

Continued

Problem	Cause	Remedy
Boiler Flooding	4. Vacuum created with boiler off	As the boiler cools off, it pulls water from the system piping. To prevent this, add a 1/4"(6mm) check valve on the steam gauge assembly piping, which closes under pressure and opens under vacuum.
Boiler has after burn when boiler shuts down	1. Bad Oil Valve	Check to see if something is holding oil valve open after it is to be closed. Clean or replace.
Oil flames coming out around the oil pump housing on shut down	1. Bad draft condition	Check draft with a gauge. Draft should be a -0.02" to -0.04"W.C. with burner off or -0.04" to -0.06" when operating.
	2. Venting of room	Check to see that doors to boiler room are closed to prevent air from being pulled out of the boiler area. Make sure proper openings are available as described in the manual.

5

Oil Burner and Ignition Assembly



Oil Burner and Ignition Assembly Components

Item	Part No.	Burner Motor	RPM	Hp
1	2-40-605	1/3HP 115/230/60/1	3450	4-15
	2-40-606	1/3HP 230/460/60/3	3450	4-15
	2-40-603	1/3HP 110/220/50/1	2850	4-15
	2-40-770	1/3HP 380/50/3	2850	4-15
	2-40-608	3/4HP 115/230/60/1	3450	20-30
	2-40-611	3/4HP 230/460/60/3	3450	20-30
	2-40-609	3/4HP 110/220/50/1	2850	20-30
	2-40-772	2.0HP 380/50/3	2850	40-60
	2-40-616	2.0HP 115/230/60/1	3450	40-60
	2-40-618	2.0HP 230/460/60/3	3450	40-60
	2-40-617	2.0HP 110/220/50/1	2850	40-60
	2-40-621	3.0 HP 230/460/50/60/3	2850/3450	80-100
	2-40-773	3.0HP 380/50/3	2850	80-100

*The correct part number is located on the burner motor.

Item	Part No.	Burner Scroll Casting	Hp
2	2-11-123	Burner Scroll Casting	4-15
	5-20-059	Burner Scroll Casting	20
	5-20-060	Burner Scroll Casting	30
	2-11-126	Burner Scroll Casting	40-60
	2-11-121	Burner Scroll Casting	80-100

Item	Part No.	Burner Fan	Fuel	Hz	Hp
3	2-30-462	5-1/2×1×5/8	#2 Oil	60	4
	2-30-410	6-1/4×1-1/2×5/8	#2 Oil	50/60	6
	2-30-412	7×1-1/2×5/8	#2 Oil/ Comb.	60	10
	2-30-413	7×2×5/8	#2 Oil/ Comb.	50	10
	2-30-414	7-11/16×1-1/2×5/8	#2 Oil/ Comb.	60	15-20
	2-30-417	8-3/8×1-1/2×5/8	#2 Oil/ Comb.	50	15-20
	2-30-418	8-3/8×2×5/8	#2 Oil/ Comb.	60	30
	2-30-431	9-15/16×1-1/2×5/8	#2 Oil/ Comb.	50	30
	2-30-425	9-3/16×2-1/2×1	#2 Oil/ Comb.	60	40-50
	2-30-427	9-3/16×3×1	#2 Oil/ Comb.	50	40-50
	2-30-424	9-15/16×2-1/2×1	#2 Oil/ Comb.	60	60
	2-30-559	9-15/16×3×L075	#2 Oil/ Comb.	50	60
	2-30-437	9-15/16×3-1/2×1	#2 Oil/ Comb.	60	80-100
	2-30-439	10-5/8×4×1	#2 Oil/ Comb.	50	80-100

*The correct part number is located on the back of the fan plate.

Item	Part No.	Ignition Transformer
4	2-40-086	120/60/1
	2-40-087	240/60/1
	2-40-088	120/50/1
	2-40-089	240/50/1

Continued

Item	Part No.	Air Deflector	HP
5	7-20-080	Air Deflector	6-15
	7-20-082	Air Deflector	20-30
	7-20-084	Air Deflector	50-60
	7-20-086	Air Deflector	80-100

Item	Part No.	Oil Nozzle	HP
6	2-30-048	1.20 GPH-80	4
	2-30-050	1.65 GPH-80	6
	2-30-052	2.25 GPH-80	10
	2-30-054	3.00 GPH-80	15. 30
	2-30-056	4.00 GPH-80	20. 40
	2-30-057	5.00 GPH-80	50
	2-30-058	6.00 GPH-80	60
	2-30-059	8.00 GPH-80	80
	2-30-060	10.00 GPH-80	100
		13.00 GPH-80	130

*30-150HP require two

Item	Part No.	Magnetic Oil Valve
7	2-30-130	Magnetic Oil Valve 115V
	2-30-129	Magnetic Oil Valve 230

Item	Part No.	Oil Pump	HP
8	2-30-134	Oil Pump #2 oil	4-30
	2-30-135	Oil Pump #2 oil	40-100
	2-30-127	Oil Pump #4 to #6 oil	

Item	Part No.	Flame Detectors	HP
9	2-40-221	Cad Cell With Holder	4-10
10	2-20-007	Cad Cell Adaptor	4-10
11	2-40-161	Scanner for 7800 Series	15-100

Item	Part No.	Couplings	HP
12	4-30-010	Coupling Fan to Oil Pump	4-15
	4-30-012	Coupling Fan to Oil Pump	20-30
	2-30-191	Coupling Fan to Oil Pump	40-100
13	2-30-190	Coupling Fan to Oil Pump	40-100
	2-30-039	Coupling Fan to Oil Pump	4-30

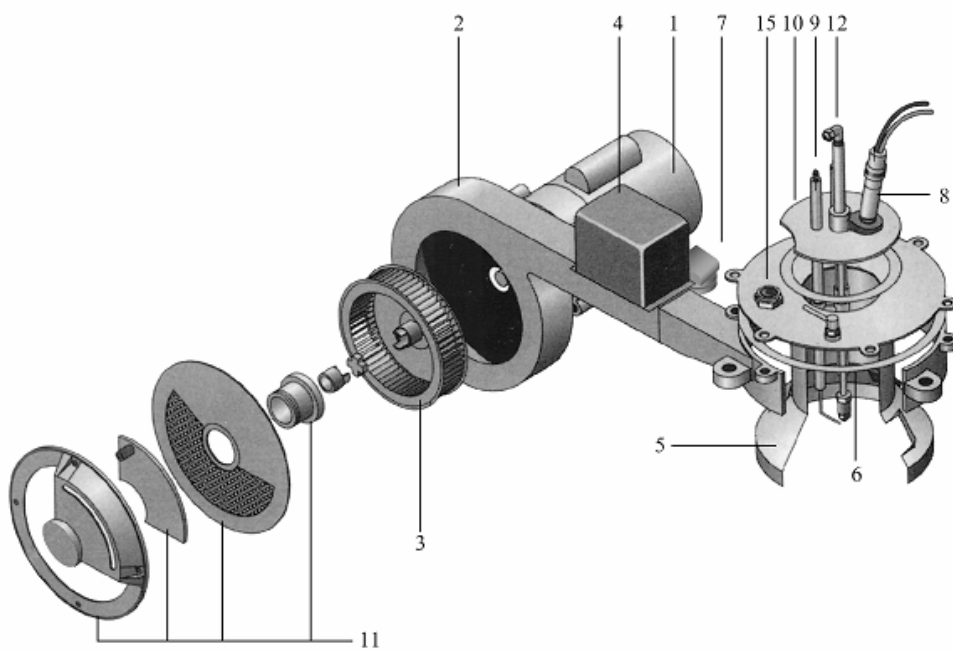
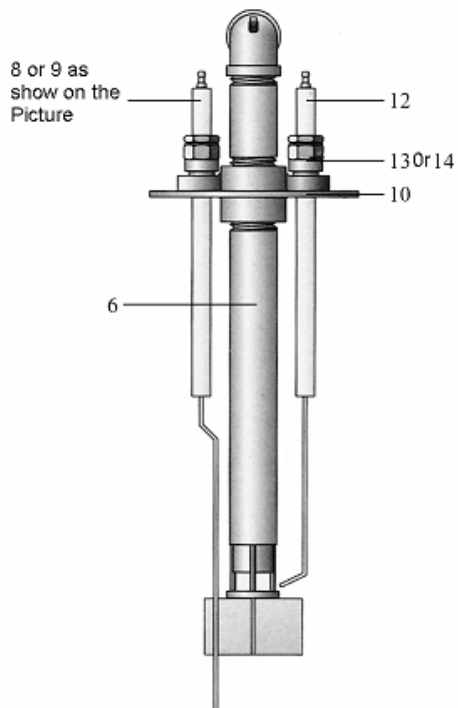
Item	Part No.	Burner Plate	HP
14	5-20-063	Oil Burner Plate	4
	5-20-008	Oil Burner Plate	6-20
	5-20-009	Oil Burner Plate	30-100

Item	Part No.	Air Gate	HP
15	5-20-065	U.K. Air Gate	4-15
	5-20-066	U.K. Air Gate	20-100

Continued

Item	Part No.	Electrode Parts		HP
16	2-20-021	11" Ignition Electrode		4-100
17	2-30-149	Ignition Electrode Holder		4-20
18	5-20-021	Ignition Electrode Holder		30-100
19	2-12-014	Pyrex Plate Glass 1"		4-100
20	2-20-003	Single Oil Nozzle Adaptor		4-20
	2-20-004	Double Oil Nozzle Adaptor		30-100

Gas Burner and Ignition Assembly



Gas Burner and Ignition Assembly Components

Item	Part No.	Burner Motor	RPM	Hp
1	2-40-605	1/3HP 115/230/60/1	3450	4-15
	2-40-606	1/3HP 230/460/60/3	3450	4-15
	2-40-603	1/3HP 110/220/50/1	2850	4-15
	2-40-770	1/3HP 380/50/3	2850	4-15
	2-40-608	3/4HP 115/230/60/1	3450	20-30
	2-40-611	3/4HP 230/460/60/3	3450	20-30
	2-40-609	3/4HP 110/220/50/1	2850	20-30
	2-40-771	1.5HP 380/50/3	2850	40-60
	2-40-613	1.5HP 115/230/60/1	3450	40-60
	2-40-615	1.5HP 230/460/60/3	3450	40-60
	2-40-614	1.5HP 110/220/50/1	2850	40-60
	2-40-621	3.0 HP 230/460/50/60/3	2850/3450	80-100
	2-40-773	3.0HP 380/50/3	2850	80-100

*The correct part number is located on the burner motor.

Item	Part No.	Burner Scroll Casting	Hp
2	2-11-123	Burner Scroll Casting	4-15
	5-20-059	Burner Scroll Casting	20
	5-20-060	Burner Scroll Casting	30
	2-11-126	Burner Scroll Casting	40-60
	2-11-121	Burner Scroll Casting	80-100

Item	Part No.	Burner Fan	Fuel	Hz	Hp
3	2-30-407	5-1/2×1-1/2×5/8	Propane/ Natural gas	50/60	4
			Propane	50/60	6
	2-30-410	6-1/4×1-1/2×5/8	Natural gas	50/60	6
	2-30-412	7×1-1/2×5/8	Propane/ Natural gas	50/60	9.5-10
	2-30-414	7-11/16×1-1/2×5/8	Propane/ Natural gas	50/60	15-20
	2-30-418	8-3/8×2×5/8	Propane/ Natural gas	50/60	30
	2-30-421	8-3/8×2-1/2×1	Propane/ Natural gas	50/60	40-50
	2-30-425	9-3/16×2-1/2×1	Propane/ Natural gas	50/60	60
	2-30-437	9-15/16×3-1/2×1	Propane/ Natural gas	50/60	80-100
			Propane/ Natural gas	50/60	80-100

*The correct part number is located on the back of the fan plate.

Item	Part No.	Ignition Transformer
4	2-40-082	120/60/1
	2-40-083	240/60/1
	2-40-084	120/50/1
	2-40-085	240/50/1

Item	Part No.	Air Deflector	HP
5	2-11-112	Air Deflector	4-10
	2-11-075	Air Deflector	9.5
	2-11-113	Air Deflector	15-20
	7-20-090	Air Deflector	30
	7-20-092	Air Deflector	40-60
	7-20-074	Air Deflector	80-100

Continued

Item	Part No.	Gas Orifice (Propane)	HP
6	7-20-050	7-20-030	4
	7-20-051	7-20-061	6
	7-20-078		9.5
	7-20-052	7-20-062	10
	7-20-023	7-20-033	15
	7-20-054	7-20-064	20
	7-20-055	7-20-065	30
	7-20-265	7-20-275	40
	7-20-056	7-20-066	50
	7-20-057	7-20-067	60
	7-20-058	7-20-068	80
	7-20-059	7-20-069	100

Item	Part No.	Air Switch	HP
7	2-30-118		4-100

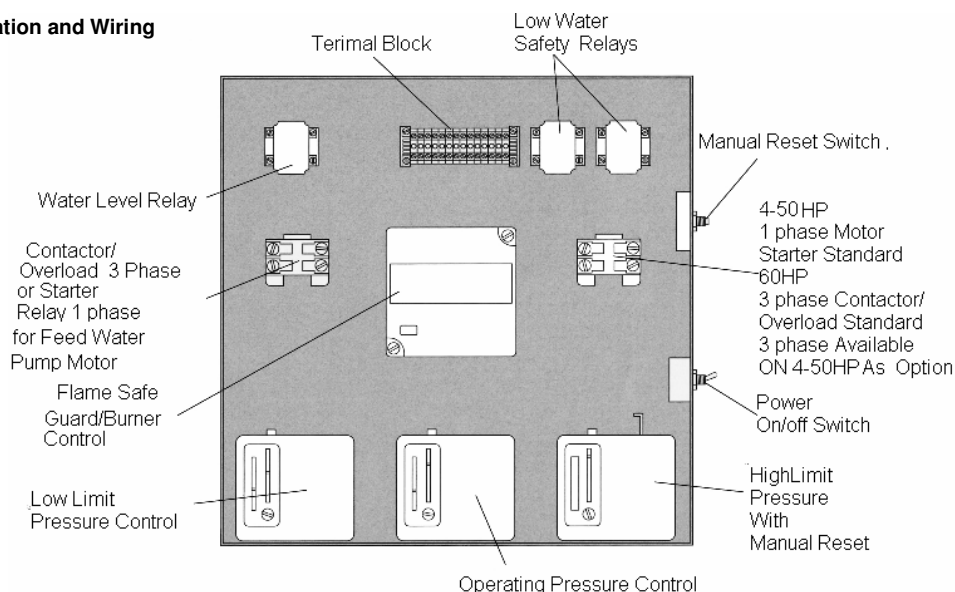
Item	Part No.	Scanner	HP
8	2-40-161	Scanner for 7800 Series	5-100
9	2-20-020	Flame Rod	4-30

Item	Part No.	Burner Plate	HP
10	5-20-019	Burner Plate	4
	5-20-007	Burner Plate	6-10
	5-20-055	Burner Plate	9.5
	5-20-013	Burner Plate	15-20
	5-20-018	Burner Plate	30-60
	5-10-398	Burner Plate	80
	5-10-399	Burner Plate	100

Item	Part No.	Air Gate	HP
11	5-20-017	Air Gate	4-10
	5-20-012	Air Gate	15
	5-20-011	Air Gate	20-30
	5-20-066	U.K. Air Gate	40-100

Item	Part No.	Electrode Parts	HP
12	2-20-021	11" Ignition Electrode	4-100
13	2-30-149	Ignition Electrode Holder	4-20
14	5-20-021	Ignition Electrode Holder	30-100
15	2-12-014	Pyrex Plate Glass 1"	4-100

EC7830A Installation and Wiring



Wiring EC7830A

Terminal No.	Abbreviation	Description	Ratings
G		Flame Sensor Ground ¹	
Earth G		Earth Ground ¹	
N		Line Voltage Common (Neutral)	
3	AL	Alarm (Normally Open)	220/230/240 Vac, 1A, 10A inrush
4	FAN	Burner/Blower Motor	220/230/240 Vac, 4A, at PF=0.5A, 20A inrush
5	LI	Line Voltage Supply (L1)	220,230 Vac (+/-10%), 50Hz (+/- 10%).
6	RT	Limits and Burner Control	220/230/240 Vac, 5A (maximum)
7	LD2	Airflow Switch Input	220/230/240 Vac, 1 mA
8	PV1	Pilot Valve 1 (Interrupted)	220/230/240 Vac, 4A at PF=0.5A, 20A inrush. ³
9	MV	Main Fuel Valve	220/230/240 Vac, 4A at PF=0.5A, 20A inrush. ³
10	IGN	Ignition	220/230/240 Vac, 2A at PF=0.2. ³

Terminal No.	Abbreviation	Description	Ratings
F(11)		Flame signal	136-220Vac,50HZ,limited current R7886 input(maximum)50Vdc
			"input" maximum for R7886.
16		Control Voltage	230 Vac (+15/-19%), 50Hz (+/-10%). ²
17	ES2	Pre-ignition Interlock Input	220/230/240 Vac, 1 mA
20	LOS	Lockout Input	220/230/240 Vac, 1 mA
21	PV2	Pilot Valve 2 (Intermittent)	220/230/240 Vac, 4A at PF=0.5A, 20A inrush. ³
22	SHTR	Shutter	120 Vrms (chopped 230 Vac), 100mA, 50 Hz

*The EC7830A must have an earth ground providing a connection between the base and the control panel or the equipment. The earth ground wire must be capable of conducting in event of an internal short circuit, fusing 2A fuse or circuit breaker. 7830A have a low impedance ground connection to the equipment frame which, in turn, needs a low impedance connection to earth ground. For a ground path to be low impedance at RF frequencies, the connection must be made with minimum length conductors that have maximum surface areas. Wide straps or brackets are preferred rather than lead wires. Be careful to

ensure that mechanically tightened joints along the ground path, such as pipe or conduit threads or surfaces held together with fasteners, are free of nonconductive coatings and are protected against mating surface corrosion.

*2000 W maximum connected load to EC7830A Assembly. Use section that more than 2.5mm² soft wires to connect. The power must insure the rated requires and fit voltage regulator power, otherwise not in warranty range.

*Total load current, excluding Burner motor and firing transformer outputs cannot exceed 5A, 25A inrush.

Parts

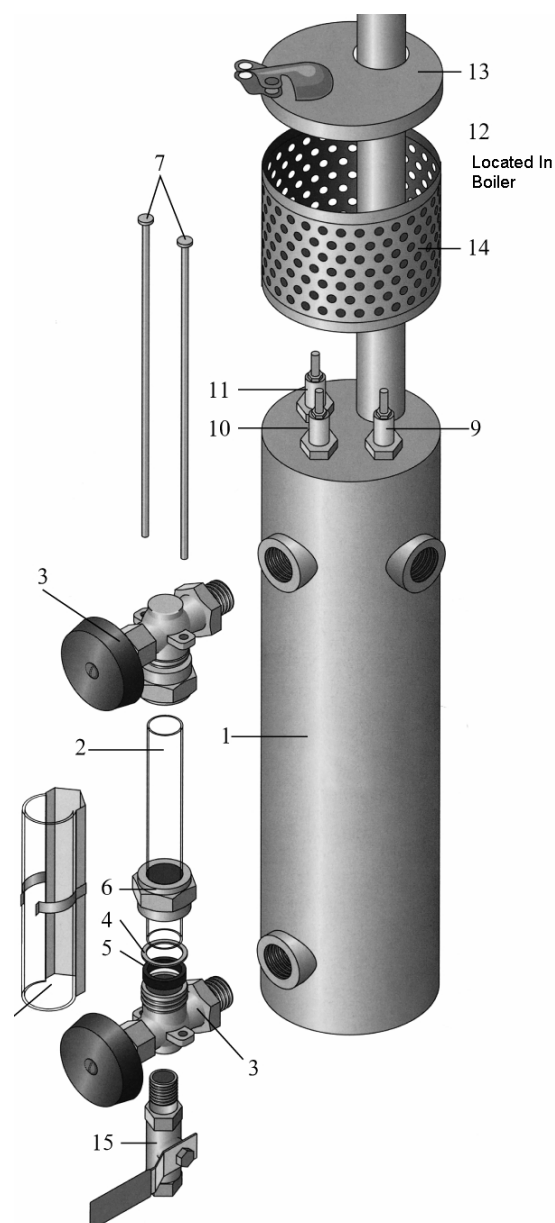
Water Column Parts

Part No.	Water Column Bottle Casting(1)	BHP
5-20-022	Water Column Bottle Casting	4-30
5-20-048	Water Column Bottle Casting	50-100

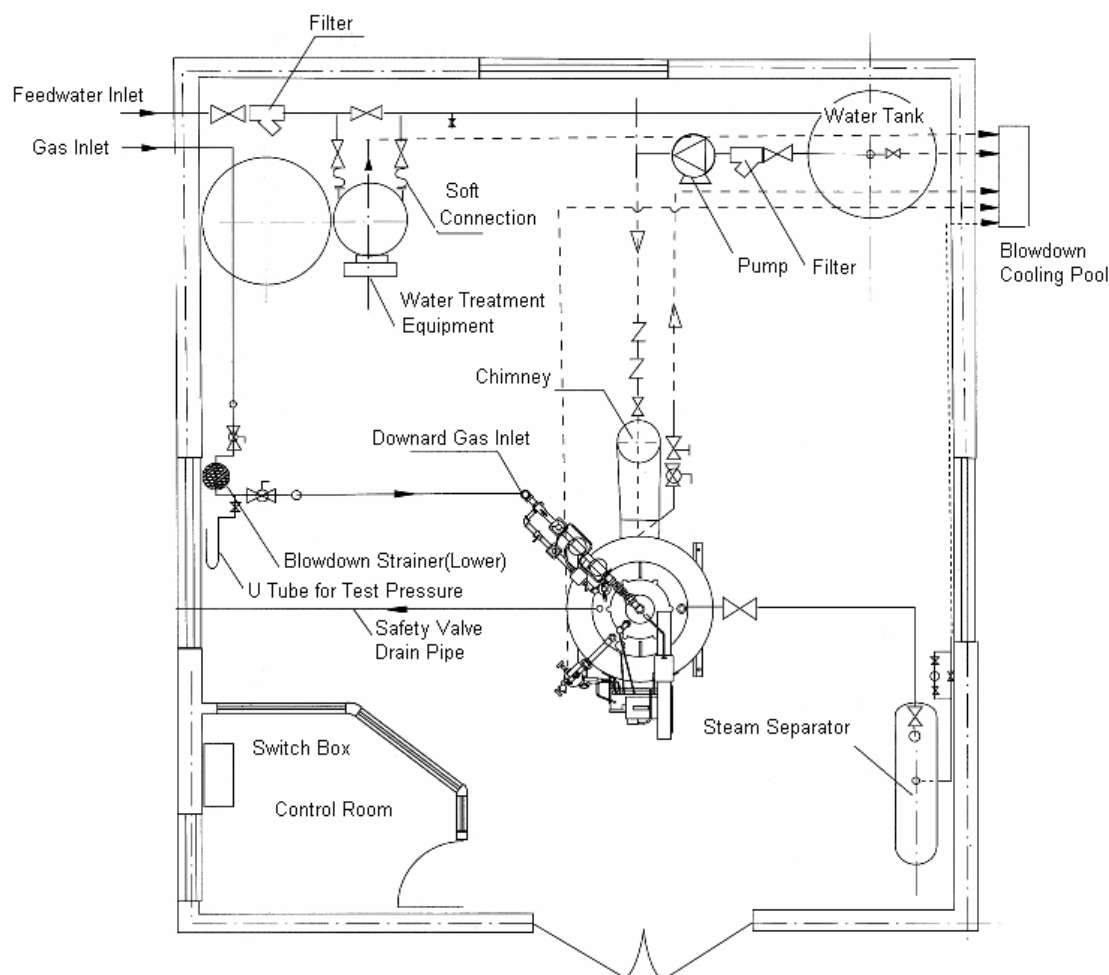
Part No.	Water Gauge Glass(2)	BHP
2-12-017	9-1/4" Water Gauge Glass-Coming	4-100
2-12-065	8-5/8" Extra Heavy Gauge Glass	9.5

Part No.	Water Gauge Glass Trim	BHP
2-30-149	Water Gauge Glass Valves w/Ball Checks(3)	4-100
2-30-155	Conbraco 250#GG Valve w/Ball Check	9.5
2-12-020	Brass Water Gauge Glass Gasket(4)	4-100
2-12-019	Rubber Water Gauge Glass Gasket(5)	4-100
2-35-514	Brass Packing Nut for Gauge Glass Valve(6)	4-100
2-30-330	Gauge Glass Protector Rods(7)	4-100
2-12-022	Lucite Gauge Glass Guard -9-1/4" Glass(8)	4-100
2-12-204	Lucite Gauge Glass Guard -8-5/8" Glass(8)	9.5

Part No.	Water Level Probes	BHP
2-20-010	Pump Off Probe- 7-1/4" (9)	6-100
2-20-011	Pump On Probe- 9-1/4" (10)	6-100
2-20-012	Low Water Probe in Water Column- 11-1/4" (11)	6-100
2-20-017	Low Water Probe in Boiler – 17-1/8" (12)	6-100
2-21-012	Probe Cover(13)	4-100
2-21-013	Probe Basket (14)	4-100
2-30-398	1/4" Ball Valve for Water Column (15)	4-100



Sketch of Layout for Boiler Room of 4-150HP Fulton Oil/Gas fired Steam Boilers



Note

1. This layout is a reference for Fulton oil/gas fired steam boilers.
2. The boiler room must be in accordance with the local code and related fire prevention and control code , and the oil tank should fit with firewall.
3. There should be set two venting of up and down according to the size of the boiler room.
4. The chimney can be installed at the roof after it is extend the roof or the wall in accordance with the manual.
5. Gas intake pressure must be in accordance with the rated requires for boiler. Otherwise, set pressure reducing valve or pressure regulator valve at he outlet of filter. (pump inlet pressure is no more than -10" of mercy, including oil filter and resistance of line, pump inlet height should be higher 500mm than outlet, but no leakage and air resistance occur, and set resistance turning check valve on lines, especially when tone line is feeding two boilers.
6. If necessary, fit soft connection pipe for circling pump, and expanded tube must be located between the high level water tank and the return water intake.

6

3 Year Conditional Warranty

On the Fulton Boiler Pressure Vessel

Fulton Boiler Works, Inc. will repair or replace any Fulton pressure vessel which, Within three (3) years of the date of shipment from factory, is found to be defective in workmanship or material, provided this equipment is installed, operated and maintained by the buyer in accordance with the Fulton instruction manual and approved practices, and that the water quality used in the system has been regularly checked to meet the standards for ideal and proper boiler feedwater during the warranty period.

This warranty does not cover damage of failure that can be attributed to corrosion, (including oxygen pitting) scale or dirt accumulations, or to low conditions. Follow feedwater and recommended treatment specifications as detailed in section 1 of the instruction manual shipped with your boiler as well as maintenance procedures as listed in section 4. This 3 year warranty applies only in the continental U.S.A and Canada. The warranty does not include labor charges of any kind. In the event a failure is reported, Fulton will require an analysis of the boiler feedwater to determine that acceptable water conditions are present at the installation site as well as documentation on the feedwater treatment employed since the installation of the boiler.

Consult Fulton Boiler Works, Inc. for analysis of acceptable water conditions.

Feedwater treatment and proper daily blowdown procedures are very important in keeping your boiler heating surfaces free of scale formation, pitting, oxygen corrosion and foaming or bouncing water. They will recommend the proper treatment required for prolonging boiler life. A thorough boiler inspection should take place during the first three months of operation to assess the effectiveness of boiler water treatment techniques, including analysis of potential oxygen pitting. It is the owner's responsibility to assure safe operation of the boiler. To avoid corrosion, scale or dirt accumulations, it is recommended that a daily blow down procedure be instituted. The boiler power should be left on during daily blow down so that correct operation in the low water relay may be checked. While blowing down the boiler, the pressure will drop significantly. While blowing boiler down with power on, it is normal to hear the boiler feed pump come on. The burner should not turn on. If the burner does come on, turn the boiler off and contact our factory immediately. Corrosive acid and chlorine based chemicals in the atmosphere can be damaging to this boiler. It is the owner's responsibility to have the boiler room periodically tested to assure these damaging chemicals are not present.

1 Year (12 Month) Standard Warranty

A. Fulton Boiler Works, Inc. will repair or replace any other part of this boiler of our manufacture which within twelve months of the date of shipment from factory is found to be defective in workmanship or material, provided the equipment has been installed, operated and maintained by the buyer in accordance with the operating instruction manual provided with the equipment and generally accepted approved practices, and on the provision that the buyer gives proper notification in writing as soon as the defect take place, and that he has properly filled out and returned his warranty card. This warranty does not include labor charges of any kind. Follow maintenance instructions as listed in the "Instruction Book."

B. But Fulton Boiler Works, Inc. does not provide any warranty for products manufactured by others.

C. The electrical elements for Fulton boilers request the working voltage in the range of 220V±10%,if the user can not ensure this request of voltage safety, voltage regulator power must be fitted. Otherwise, the electrical elements damaging caused by voltage not as request is not in the range of warranty.

Files Card for Fulton Boiler Users

Boiler Type: () Steam () Hot Water
() Oil () Gas () Oil and Gas () electric

Boiler No. _____

Company _____

Address _____

Linkman _____ Tel. _____ Postcard _____

Purchase Date _____ Distributor _____

Address and Tel _____

Direct Maintenance charger _____

Oil and Gas Filter Water Treatment Equipment
() Yes Type () No () Yes Type () No

Voltage(fit voltage regulator type _____)

220V±10% () Yes () No.

Installation Date _____ Place _____

Manage type _____ Used to _____

This boiler is () instead of the old () new

Please read carefully the user manual from Fulton , and operation and maintenance must be in accordance with this manual.

Note

- The inlet voltage of electric panel box must be kept at the ranges of 200V±10%, otherwise the controller can be damaged, and the constant voltage equipment is advised. If the boiler draft and panel box both use 220V/1, use the 3KW ,220V constant voltage with high accuracy. If the draft use 380V/3 but panel box use 220V/1, then use the 1KW ,220V constant voltage with high accuracy.
- We are not in charge of the problems caused by that the feed water is not as the manual requires (such as no soften water equipment),
- Please install fuel lines filter, otherwise the user bear themselves .

Guarantee Card of Fulton Boilers

Boiler Type: () Steam () Hot Water
() Oil () Gas () Oil and Gas () electric

Boiler No. _____

Company _____

Address _____

Linkman _____ Tel. _____ Postcard _____

Purchase Date _____ Distributor _____

Address and Tel _____

Direct Maintenance charger _____

Oil and Gas Filter Water Treatment Equipment
() Yes Type () No () Yes Type () No

Voltage(fit constant voltage equipment type)

220V±10% () Yes () No.

Installation Date _____ Place _____

Manage type _____ Used to _____

This boiler is () instead of the old () new

Thanks for purchasing Fulton Boiler, please answer these questions and send back to us.

Is it the first time that you purchase boiler? () Yes () No

Will the boiler be instead the old one ? () Yes () No

If "Yes", please indicate the instead one's type and factory. _____

If the instead one is Fulton boiler, tell us why

If the instead one is the other, tell us why _____

Do you think the price of Fulton boiler compared with the others is suitable? () Yes () No

Note

Which ways do you know about Fulton boilers?

Your Fulton Boiler is () standard () high efficiency and economic

Guarantee Card of Fulton Boiler

Which affect you the deepest among the character of Fulton boiler.

- | | |
|---|---|
| <input type="checkbox"/> Design of vertical with no tube | <input type="checkbox"/> The operation is simple. |
| <input type="checkbox"/> PV 3years warranty | <input type="checkbox"/> Maintenance easily |
| <input type="checkbox"/> Steel components of electric boiler | <input type="checkbox"/> efficiency |
| <input type="checkbox"/> Burner with special design of Fulton | <input type="checkbox"/> safety |

Talk about the impression to Fulton with simply words:

Do you still purchase Fulton boiler? ☐ yes ☐ No

Why? Please tell us the reason.

Please read carefully the user manual from Fulton, and operation and maintenance must be in accordance with this manual.

Note

- The inlet voltage of electric panel box must be kept at the ranges of $200V \pm 10\%$, otherwise the controller can be damaged, and the constant voltage equipment is advised. If the boiler draft and panel box both use 220V/1, use the 3KW, 220V constant voltage with high accuracy. If the draft use 380V/3 but panel box use 220V/1, then use the 1KW, 220V constant voltage with high accuracy.
- We are not in charge of the problems caused by that the feed water is not as the manual requires (such as no soften water equipment),
- Please install fuel lines filter, otherwise the user bear themselves.

It will be valid that this card must be written and sent back to Hang Zhou Fulton Thermal Equipment co., Ltd. after purchases 40days. (may be copies)